

Editorial



THE Broadcasting Control Board has recommended that the experimental FM stations now operating in Australia should broadcast a third national program of high quality and wide appeal.

It has already announced that it will grant FM licences to suitable applicants, and is strongly in favor of their use, even before TV services are commenced.

It sees in FM the only practicable way in which Australian broadcast services can be increased.

I am completely in agreement with the suggestion about using the existing FM stations for a high quality program. I would go further, and say that there should be similar stations erected in every large Australian city for a similar purpose.

The FM stations have led a back-water career since their installation, and few people ever listen to them. They have never been widely publicised, and because they have been officially experimental in nature, this lack of publicity has probably been intentional.

But there is no need now for them to continue on this experimental basis. Whether the stations themselves are in sufficiently good condition to undertake regular services I do not know. But there is evidence that some of them are being overhauled, and the chances are that in their new state they will be able to undertake such work.

Until there are FM stations there will not be FM receivers and vice versa. Despite the Board's encouraging words, it is hardly reasonable to expect commercial stations to spend money on FM, from which their returns will be questionable for some time, when they are faced with the problem and expense of TV.

At the same time this will not always be the case, and there will be stations not involved in TV licences which might well look to FM for an outlet.

The ABC is in a different position. It has material suitable for high-grade programs, and it already broadcasts some of these through existing FM stations. An extension of this activity on a planned basis seems to be the obvious way to break what might otherwise be an unbreakable deadlock.

I have had quite a number of queries from owners of wide range equipment about the possibility of wide-range radio from the FM stations. Undoubtedly there is a growing army of people who would welcome it. I believe the time is ripe to make a start and Radio and Hobbies will do everything in its power to help the venture to success.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

EDITOR

JOHN MOYLE
S.M.I.R.E. (Aust.)

TECHNICAL EDITOR

NEVILLE WILLIAMS
M.I.R.E. (Aust.)

TECHNICAL STAFF

RAYMOND HOWE
PHILIP WATSON
MERVYN HUDDLESTON

Vol. 18, No. 7

SUBSCRIPTION RATES

C'wealth, NZ, N. Guinea, Fiji—18/- pa
United Kingdom—£1/0/6 pa
B. Empire—£1/3/- pa
Foreign—£1/5/- pa

Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

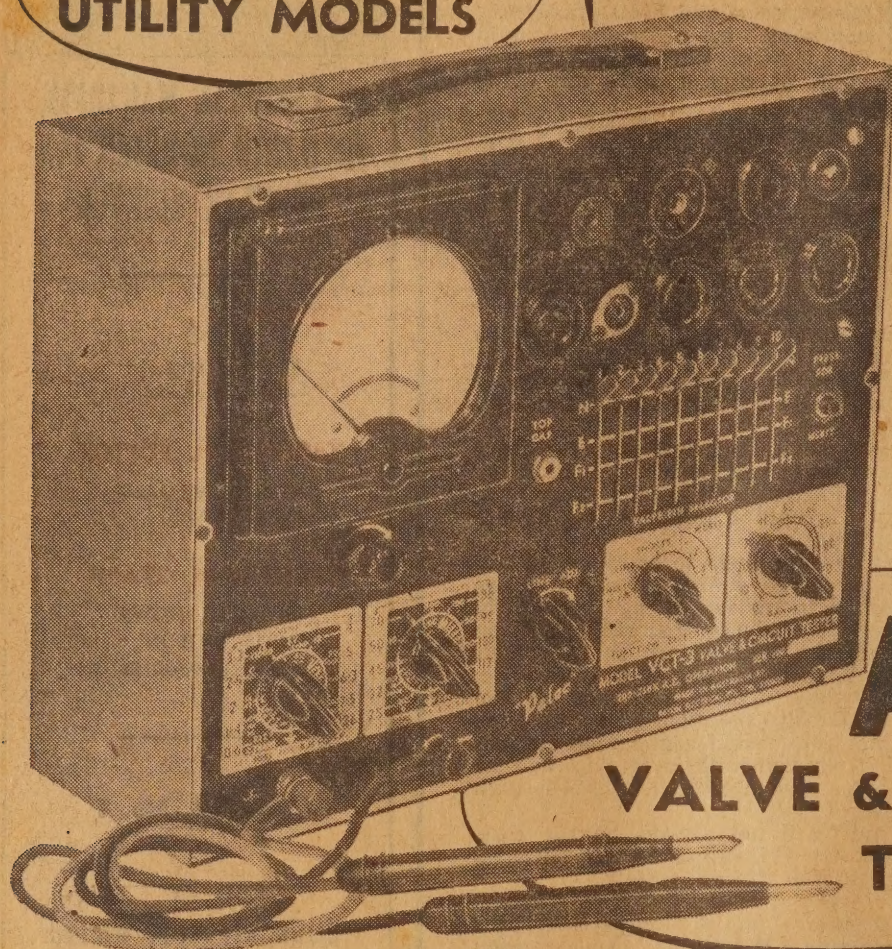
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OUR COVER PICTURE

Nothing much to do with radio, unless it is the Sydney-Hobart yacht race! Rather is it a picture of happy holidays, and this is what we wish all our readers when sunny days come along.

2 New **Palec** UTILITY MODELS

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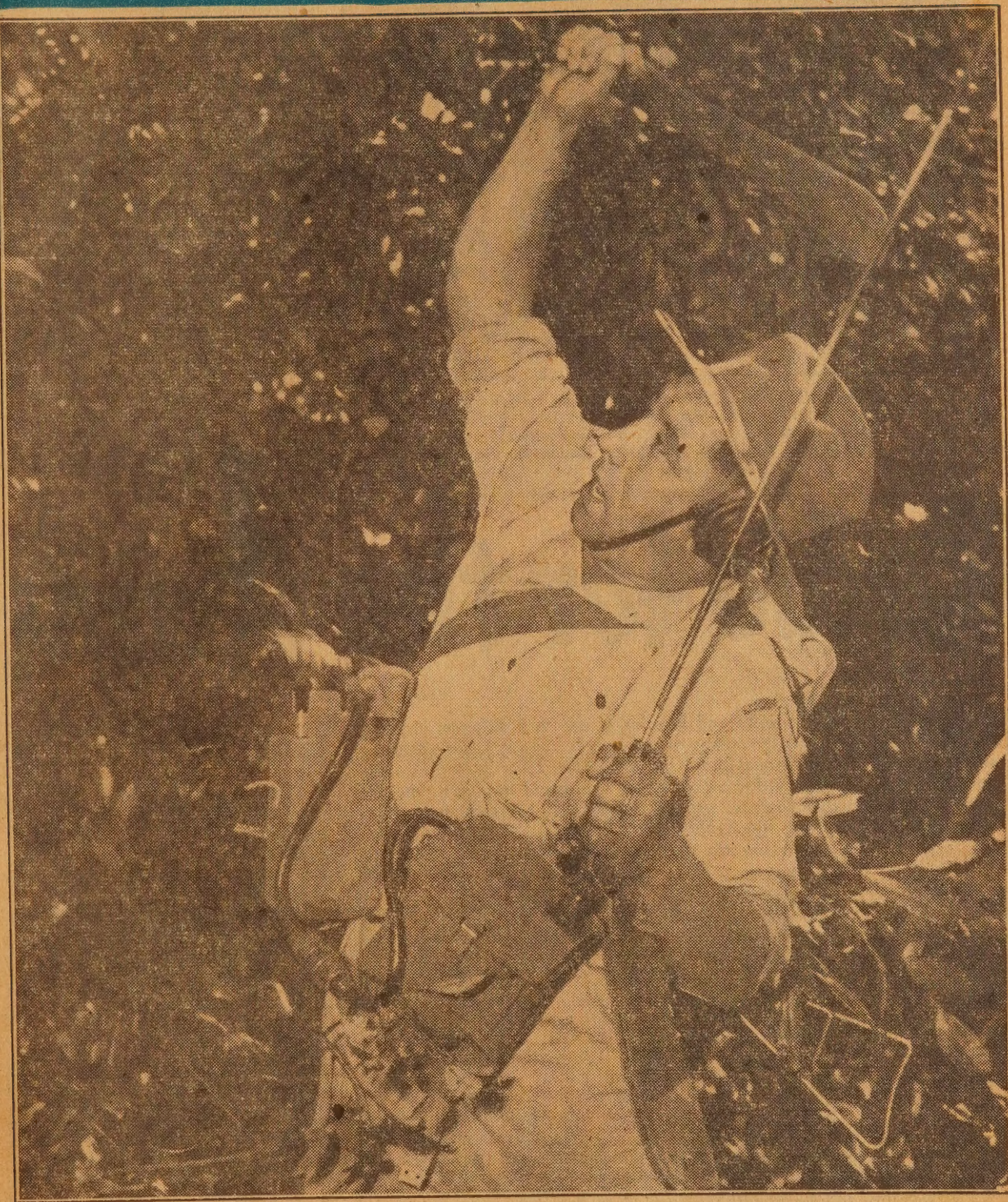
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NEW ARMY RADIO IN THE JUNGLE



The new pack communications set which has been adopted by the Australian Army has been specially designed to give maximum freedom of movement to the operator. This picture shows a soldier hacking his way through heavy growth unhampered by his burden. Both hands are free and the equipment fits snugly to his body. It is unaffected by heat, cold, water or dust. The microphone has a special mouthpiece conveniently placed which does not restrict movement. The receiver is in one pack, at the front, the transmitter in the other. (Full story on the new set begins on next page.)



Here are the main components which make up a tiny portable radio station. Easily recognisable are the carrying cases at the rear, the two units themselves, "A" and "B" batteries, aerials, both wire and whip section, headphones and handset. A 15-in ruler lies below the aerial sections to indicate size.

These are coupled together with a single cable carrying battery and control connections. They are slung in their canvas cases around the shoulders of the wearer, and carried at waist height for easy reach.

Another case is carried like a knapsack, and holds extra equipment, such as aerials and spare batteries, which may be needed during operations.

CASES ARE SEALED

Each unit is approximately the same weight, and to help achieve this, the filament battery is contained in the base of the receiver, and the high tension and bias batteries in the transmitter. Each is easily and quickly replaceable by rotating a sensibly-sized knob outside the case. The cases themselves are made of aluminium, specially processed to resist corrosion.

The controls have been kept to the absolute minimum and are grouped at the top of each unit. All joints and shafts on the cases are, so well fitted that neither water nor dust can enter. Both sets can operate totally immersed in fresh or salt water, with only the aerial above the surface.

And to make sure that any condensation inside the cases will not damage the components, each has an absorbent container of silica-gel to keep

Radio for the Army

Communications are the veins and arteries of war and defence, just as they are in industry and the things of peace. But in war, everything is an emergency. If men cannot speak to each other, co-ordinated armies become isolated groups and effective action is reduced to chaos. Speed is more important than secrecy, and radio gives speed to speech. To an army, radio is a weapon which, although it cannot fight, helps to weld fighting power into the force which strikes.

RADIO communication for the army poses its special problems, for the demands upon it are heavy. Not the least difficult of these problems applies to the radio receiving and transmitting sets which fighting men must take with them into the field, and which they use to keep touch with each other and with their points of control.

LESSONS FROM WAR

World War II taught many lessons about man-carried radio sets, and these lessons have been well learned and well absorbed. Equipment which was good enough in the early days soon became an encumbrance as mobility and speed received greater emphasis. The old inevitably had to give way to the new, and the requirements set down by the army for their mobile equipments for the future were stringent and uncompromising.

If war should come again, despite our efforts to avoid it, our soldiers must have a radio which can be carried through hot sun and bitter cold,

smothered in the water and mud of swamps, discolored by dust which creeps through impossible cracks and works its ruin.

Today the army believes it has such a radio set. You have heard it mentioned in the newspapers and seen pictures of it operating under severe test conditions. It has already been in the field in Korea and has proved capable of doing the job for which it was built.

Through the co-operation of the army and of Amalgamated Wireless (Australasia) Ltd., where the equipment was designed and is being built, we are able to give you for the first time some of the features of this new pack-set, omitting only those details of circuits and design which, for security reasons, it might not be wise to publish.

Our photographs show some of the units which have served as pilot models in the final production, but otherwise they are exactly the same as thousands of others now coming off the factory line.

The set is made up of two essential units, a receiver and a transmitter.

the inside quite dry. A small indicator fitted to each unit changes color when this container needs replacing.

And as if this were not enough, each individual component is treated to be moisture proof—special sealing for cased items, tested resistors, fixed condensers with ceramic end-pieces, through which nothing can pass. The tiny meter and tuning window are hermetically sealed.

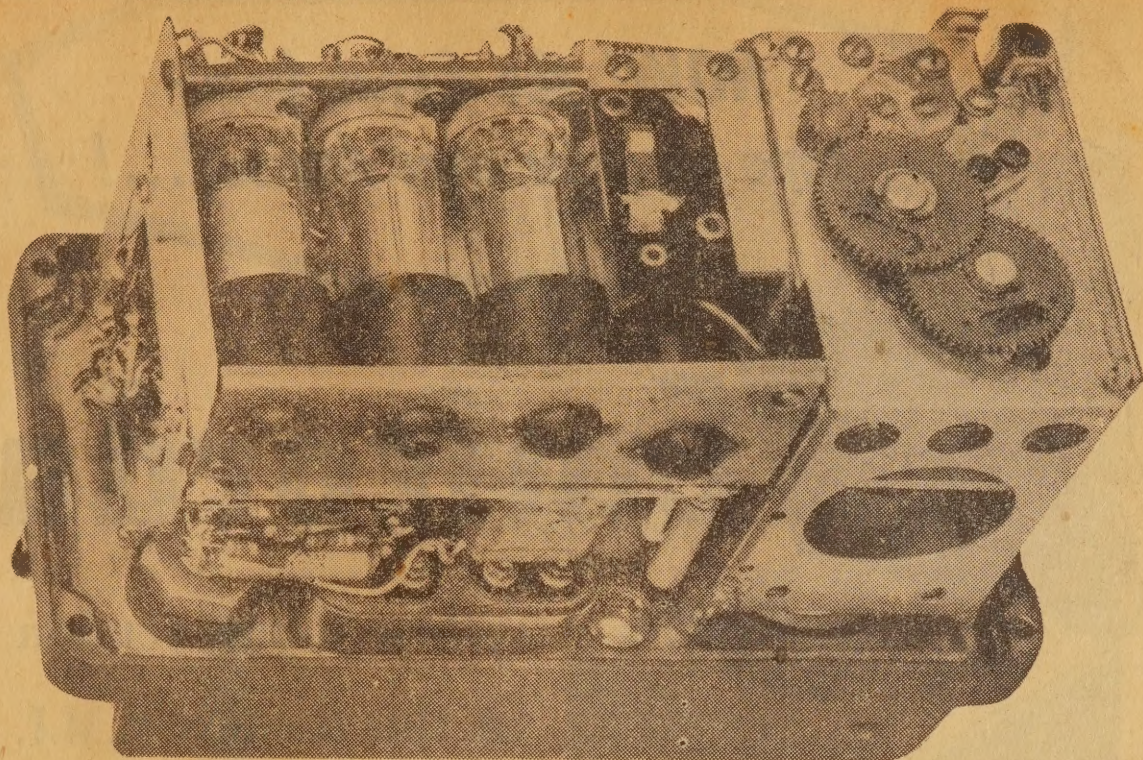
The equipment is tested over a very wide temperature range, and will work at less than minus 40 and more than plus 85 degrees Centigrade. It can be dropped several feet to hard ground, and otherwise manhandled without damage.

BATTERY OPERATED

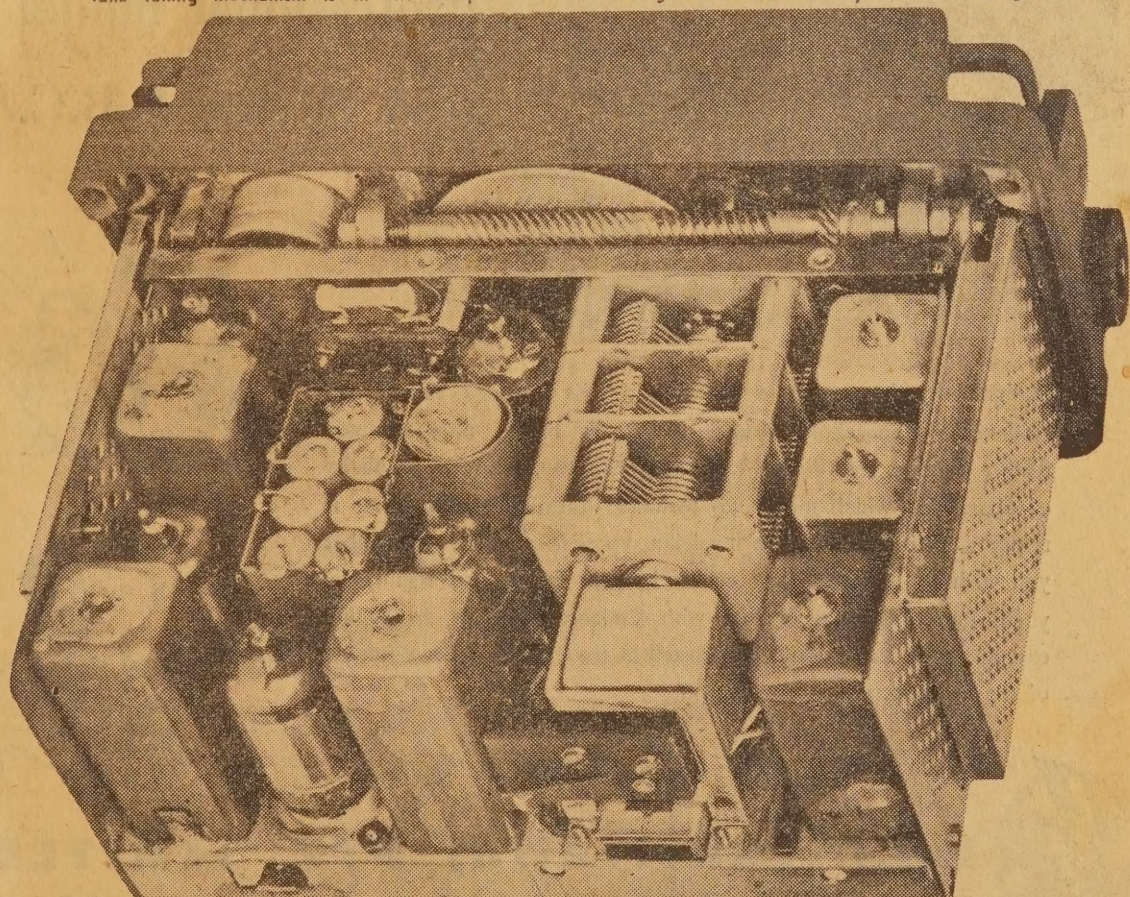
Both receiver and transmitter use battery valves of the same type as might be found in ordinary portable receivers, valves which have been proved reliable and long-lived. The receiver can run continuously for 10 hours on a single set of batteries—the transmitter for a period depending on its use.

The same batteries are used for each unit, 1.4 volts for the filaments and 90 volts for high tension. The interconnection cable joins these to a send-receive switch operated by the user.

The receiver is tuneable in two bands through a range of 2-10 Mc and has an RF stage, converter, and two IF stages plus a BFO for reception of Morse signals. The valves are



This picture of the transmitter withdrawn from its case shows the four miniature valves (one partly obscured). The final tank tuning mechanism is in the compartment at the right and is driven by the train of gears.



The receiver looks very like a small car radio. All coils and other components are individually sealed against moisture. The silica-gel container is seen at the extreme right. Note the worm-drive shaft which operates the tuning condenser and indicator dial. The containers for both units are cast aluminium treated to resist corrosion.



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1T4, 1R5, two 1T5's and a 1S5, in that order. A reflex circuit gives added sensitivity. The controls include a tuning knob with a light which can be switched on for illumination in the dark, a wave change switch to select the receiving band, and a volume control. It also has a multi-socket plug which connects up the headphones and microphone. The tuning dial has a lock adjustment to fix the dial setting when tuning is completed.

The transmitter uses four valves, a 3A4 crystal oscillator, two 3A4's in parallel in the final amplifier stage, and a 1T4 to provide grid modulation for voice operation. It can also be keyed for Morse code, for which purpose about double the power is available.

CRYSTAL CONTROLLED

Only the final amplifier stage is tuned, as the transmitter is designed to operate on a number of crystal-controlled channels. A most ingenious method of amplifier tuning is used which varies both inductance and capacitance at the same time, thus covering the full operating range without changing coils.

The transmitter is tuned by reference to a meter which reads actual power radiation from the transmitter. On maximum deflection it is correctly tuned. Simplification of this operation plus crystal control removes one of the greatest sources of operator error.

In addition to the tuning control there are two twin switches. One selects the crystal channel and adjusts for aerial matching. The other provides a "netting" position so that the receiver can be tuned to the same frequency as the crystal being used in the transmitter, and a function switch which turns the equipment on and off, and selects either voice or CW positions for the transmitter.

There is also a loaded switch to illuminate the meter face and sockets for quickly changing crystals, four of which can be fitted at one time.

The ability of the equipment to "net" to its own frequency is a valuable improvement over earlier equipment, as it does not depend on reception of any other station to set up a pre-arranged channel. Any number of these sets can therefore be adjusted to a given channel and brought into synchronised operation without test transmissions of any kind.

USE OF METER

The meter is also used for checking the conditions of the batteries, testing different circuits with different positions of the function switch.

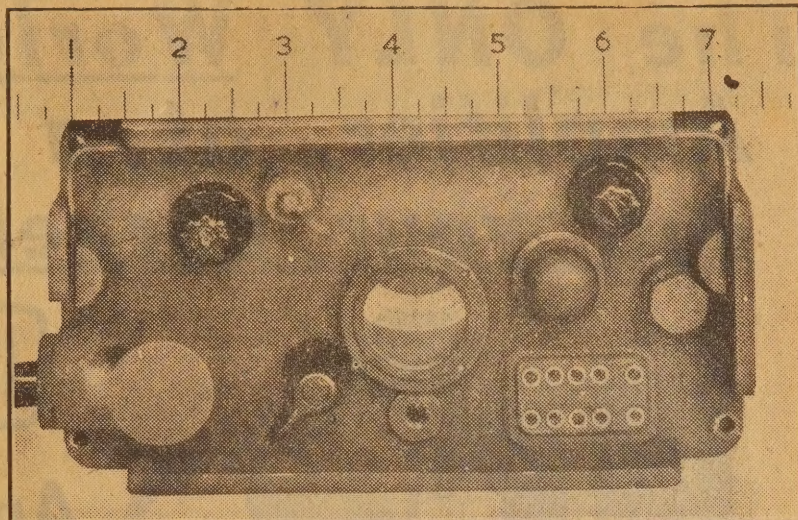
The set can be used with various types of aerials selected for use whether the operator is moving or stationary.

While on the move, a whip aerial plugs into a special terminal point on the transmitter. It is of the "loaded" type, which means the inclusion of a tuned circuit unit at the base of the whip. This can be adjusted by means of another extremely clever piece of design to suit the frequency being used.

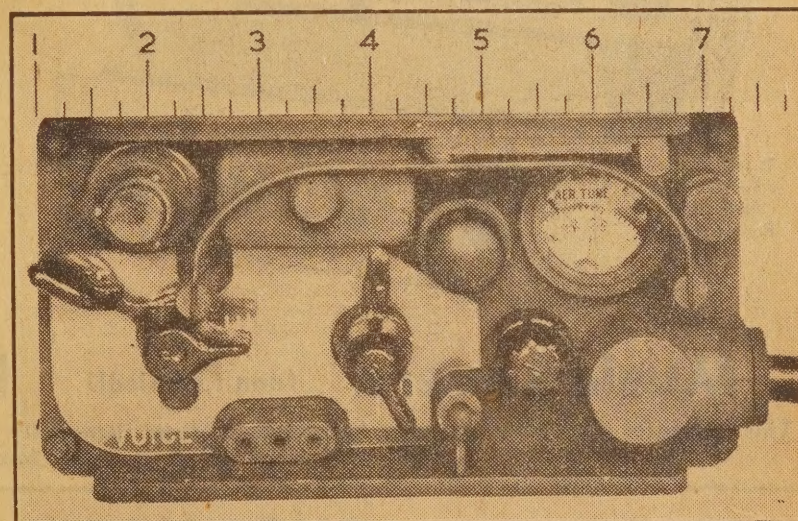
This type of whip is a big advance on the plain rod, and is universally used with modern mobile equipment. It effects a decided improvement in reliability and range.

If the user is outside the communication range using the whip, he can

FRONT PANELS OF THE TWO UNITS



The receiver front panel shows the tuning dial window at the centre plus wave-change switch, tuning knob and volume control. Immediately above the socket for headphones etc, is a spring-loaded, rubber-covered press switch to illuminate the dial face at night.



The tiny meter by which the transmitter is tuned and batteries tested is at the top right of its panel with the tank-tuning knob below it. To the left are the dual switches, and at top left the connecting post for the aerial.

sling wire aerials to some convenient tree or high point and take advantage of the better efficiency such an aerial allows. Either a single wire or a dipole aerial can be used and matched into the transmitter.

The army is somewhat cagey about quoting operating ranges, but it can be fairly assumed that several miles can be covered at almost any time, and distances of many hundreds with wire aerials and under suitable conditions. Every care has been taken to see that the maximum use is made of the necessarily low power of the transmitter. The receiver would have a range virtually as great as much larger sets.

The microphone and headset are essentially similar to the standard carbon and magnetic types, but with much improved sensitivity. The operator has a choice of a type he can wear on the march, or a lightweight telephone handset when stationary. And, of course, he has a tiny Morse key which he plugs into the transmitter when sending CW.

When assembled as a one-man pack set, the total weight of the equipment and the extras he must carry is 22lb.

From this description it will be seen that, despite its size and miraculously compact construction, the equipment is flexible enough to operate under any conditions which might be experienced in the field. At the same time, the controls have been so grouped that adjustments can be made, day or night, with the utmost speed. Once set, operating is reduced to a single-hand job, and the flap of the transmitter cover need not even be opened to do it.

More than this, we cannot say. The engineering and circuit details for the moment remain the army's in parallel in the final amplifier secret. But from our observation we can only record that not only has the army received a remarkably efficient and robust radio set, but that the Australian engineers who produced it have rendered a great service to their country.

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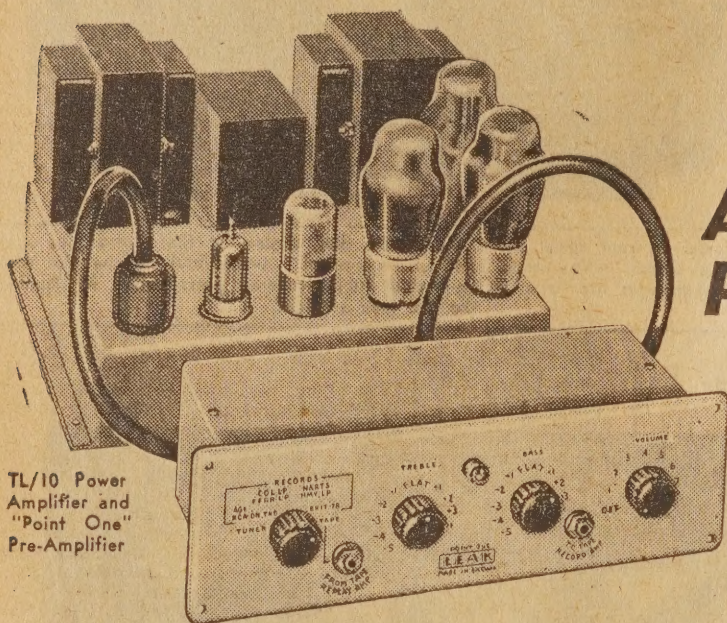
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SPECIFICATIONS

Circuitry: A triple loop feedback circuit based on the famous TL/12. The output transformer is the same size as in the TL/12.

Maximum Power Output: 10 watts.

Frequency Response: plus/minus 1 db 20 c/s to 20,000 c/s.

Harmonic Distortion: 0.1 pc, 1,000 c/s 7.5 watts output.

Feedback Magnitude: 26db. main loop.

Damping Factor: 25.

Hum: 80 db referred to 10 watts.

Loudspeaker Impedances: 16 ohms, 8 ohms and 4 ohms.

★ **Pickup:** The Pre-Amplifier will operate from any pickup generally available in the world. A continuously variable input attenuator at the rear of the pre-amplifier permits the instantaneous use of crystal, moving-iron and moving-coil pickups.

★ **Radio:** The radio input sockets at the rear permit the connection of any tuner unit. An input attenuator is fitted. H.T. and filament supplies are available from the pre-amplifier.

★ **Distortion:** Of the order of 0.1 pc.

★ **Hum:** Negligible due to the use of recently developed valves and special techniques.

★ **Input Selector:** Radio, Tape, Records; any and all records can be accurately equalised.

★ **Treble:** Continuously variable, plus 9 db to minus 15 db at 10,000 c/s.

★ **Bass:** Continuously variable, plus 12 db to minus 13 db at 40 c/s.

★ **Volume Control and Switch:** The switch controls the power supply to the TL/10 power amplifier.

★ **Tape Recording Jacks:** An exclusive feature. Readily accessible jacks are provided on the front panel for instantaneous use.

For further information contact your local dealer

Professional Engineers
please Note:

The TL/10 Amplifier in combination with "Point One" Pre-Amplifier does not supersede the famous TL/12 Power Amplifier in combination with Vari-slope Pre-Amplifier which is still Standard Production.

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CURRENT CLOSE-UP OF SCIENCE

Radioactive Bison

A RCHAE-
OLOGY used to be a quiet, inoffensive sort of science centred around a lot of holes dug in the ground in out-of-the-way parts of the world. But not any more. Any archaeologist worth his salt now has to cope with things like geiger counters and cosmic rays.

One of the most exciting developments in modern archaeology has been the use of radioactivity to estimate the age of specimens. Anything that has lived, no matter how long ago, is radioactive. And by measuring its radioactivity we can tell how long it is since it was alive.

The source of the radioactivity is the carbon dioxide in the air. A small proportion of the carbon as atmospheric carbon dioxide is always radioactive as a result of bombardment by cosmic rays.

So long as a plant or animal is alive, the proportion of radioactive carbon to ordinary carbon in its body remains constant. But when a living thing dies, it stops replenishing itself with fresh supplies of carbon. The radioactive carbon inside it decays slowly and steadily in its remains. And by measuring the proportions of radioactive carbon in an old bone, or a piece of wood or leather, we can estimate how long it is since it was alive.

By studying the radioactivity of a bit of bison bone with an arrowhead in it, archaeologists have proved that people were being unkind to bison living in North America 10,000 years ago.

Whales Reserve Oxygen

WHALES have always been a source of irritation to scientists. They're so difficult to study. You can't go out and collect a few whales and bring them back to the laboratory. The only way to tackle the job is to visit the whale where it lives, and this generally means a trip to the Antarctic. Even then, it's not so easy to persuade the whale to co-operate. Yet there are so many intriguing things about a whale that scientists have found the trip with whaling expeditions well worth while.

One thing that has always puzzled us about the whale is that it can stay under the water for so long. It is a warm-blooded animal, and has a bloodstream fed by oxygen from the air. Yet it can hold its breath under water for minutes on end without recharging the supplies of oxygen in its blood.

It has been found that the whale carries a sort of blood storage system. When it is on the surface, the whale impregnates its blood with oxygen. But only a proportion of the blood is actually being used to provide the tissues with oxygen. The rest is held in reserve, and is only used when the whale has to hold its breath under the water.

By **J. GORDON COOK,**
BSc, PhD.

Eccentric Barnacles

OF all the animals that have chosen to live a seashore life, there are few as eccentric as the barnacle. These little creatures cling like millions of midget volcanoes to the surface of rocks and piers around our coasts. Though they look like limpets, with comical-shaped shells, barnacles are not shellfish; they are crustaceans, related to the shrimps and crabs.

When it is young, the barnacle lives a free-swimming life. Eggs thrown out by the mother barnacle from her residence on the rock turn into little shrimp-like animals that swim around in the water. As like as not, the youngsters are eaten by something else; but those that survive go through five or six moulting stages before the zest for freedom deserts them.

Then the young barnacle-shrimp begins to feel like settling down. So it looks for an attractive plot on a rock or pier, or on the bottom of a ship. Then it cements itself to the surface by its head, rolls over and starts to build a shell around itself. Its eyes disappear and its legs turn into fan-shaped gadgets that can be waved about in the water through a hole that is left in the top of the shell. With these fans, the barnacle scoops up bits of food that are floating past.

When it is replete, or the tide goes back and leaves it high and dry, the barnacle closes up the hole in its shell with two pairs of plates that act like garage doors.

To the shipowner, barnacles are a serious pest. They will cling to the entire undersurface of a ship, covering it with a layer of rough shell that increases the friction of the ship moving through the water. The cost of barnacle-fouling can amount to more than £1000 on a ship travelling from Cape Town to London.

The barnacle bill for the British merchant fleet as a whole runs into millions of pounds a year.

Frog in the Throat

IN the desiccated regions of the Australian bush, water is often more valuable than food. The aboriginal, who has survived under the most primitive conditions, is able to eke out his water supplies by catching frogs. Certain types of frogs have learned to store up water inside them, and the aboriginal simply bites the frog in two, drinks the water, and throws the rest away.

Crystals in Guided Missiles

WHEN we listened to radio through our headphones years ago, we used to fiddle about with a cat's whisker and a crystal. Then valves came in, and the crystal went out. But now, the crystal has become the latest thing in radio technique again.

Crystals are replacing valves in the electronic equipment that is gradually assuming control of the world. And silicon from sand is one of the favored elements for these crystals. The development of the electronic gadgets that control guided missiles is going to depend upon the silicon which we find in ordinary sand.

About five years ago, scientists found that certain crystals could regulate the flow of electricity by encouraging it to move one way but not the other. They acted like the turnstiles controlling a football crowd. These crystals could be used in place of the valves in electronic devices, such as radio, television and radar.

Germanium, a metal found in the flue-dust of coal, was used for this job, and became the basis of what are now called transistors. In place of a delicate, complex and comparatively cumbersome valve, our electronic engineers could use a transistor of germanium metal. Just the thing for making midget electronic devices that had to be robust enough to stand a lot of knocking about.

Germanium, however, is a comparatively rare and expensive metal. Also, it will not stand very high temperatures. Silicon can operate as a transistor at temperatures which make germanium useless.

Grinding the Steak

THERE is, at last, some prospect of being able to cope with one of life's most embarrassing experiences. An enterprising dentist has invented a tooth that will grind its way through even the most resilient mouthful of indestructible steak. Steak that makes even butchers blanch.

The super-tooth is giving a new lease of life to hearty eaters suffering under the constraint of inadequate artificial teeth. Made on the meat-grinder principle, the tooth has holes in the top through which the food is forced; it emerges, ground up, lower down.

EARTH'S nearest neighbor in the sky, the planet Venus, may have a surface completely covered by oceans.

This proposal contradicts earlier suggestions that there is little or no water on that planet, and makes the possibility of life on Venus more plausible than has previously been thought.

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SWINGING AN AIRCRAFT COMPASS

Swinging an aircraft compass isn't the easiest job in the world particularly when the aircraft happens to be as big as the Super Constellation. We tell of an ingenious method adopted by the *Compania de Cubana de Aviacion* which operates airlines between Madrid, Mexico City and other world centres.

SWINGING the compass on a ship isn't such a problem, for the ship can be sailed in a circle while the various compass points are checked off.

But an aircraft flies too fast for this to be effective so that other more convenient methods must be devised.

These big planes have three separate compasses in addition to half-a ton of electronic navigational equipment, and all must be adjusted to the highest possible degree of accuracy.

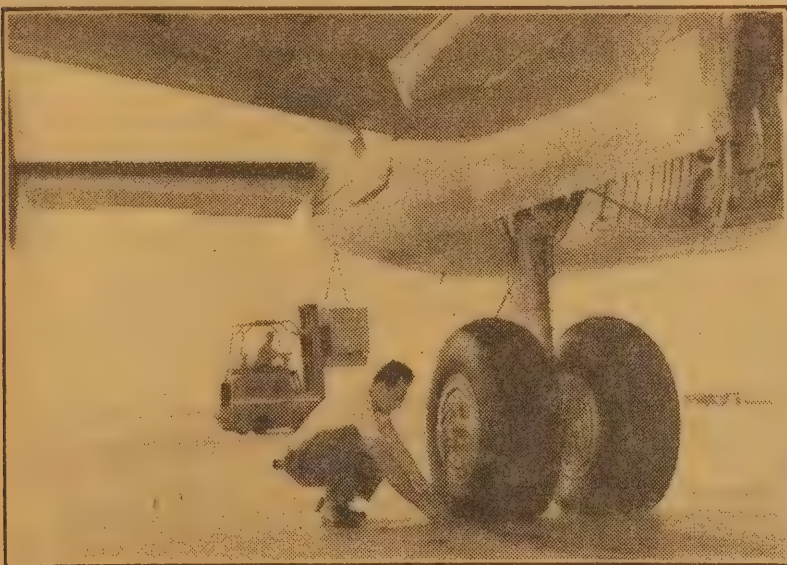
Since the aircraft can't be turned in the air it must be turned on the ground.

But first instrument specialists set about removing any magnetic influences immediately surrounding each compass. This involves a process of demagnetising any metals in the vicinity which might have picked up some stray fields. Specifications call for compass accuracy better than three degrees even before final corrections are made to improve substantially on this figure.

When ready, the aircraft is placed in the centre of an accurately marked "rose" from which the various compass check points radiate. The next step is to rotate the aircraft without moving it from its centre position.



A flight mechanic connects a shackle into the reinforced fitting at the tail of the Super Constellation while the 3500lb weight is manoeuvred in the fork-lift of the goose. Men in the background are hurrying to the concrete apron which has been surveyed and marked accurately with magnetic compass points for instrument checks.



A mechanic attaches a plumb-bob to the wheel of the huge transport to align it accurately with the markings of the huge compass rose. The aircraft is so carefully balanced that little force is needed to move it. Several trips around the rose recheck on compass settings.

To do this a special non-magnetic wheeled cart is placed under the aircraft nose to take its weight and the nose landing wheel is retracted.

Next a large concrete block weighing 3500lb is suspended from the tail so that the aircraft is virtually balanced on the main landing wheels. In this state it can be pushed around with comparative ease.

The pushing is done by means of a strange looking ground vehicle which presses at the side of the concrete block. Step by step the aircraft is rotated, being lined up to each of the check points, with careful positioning to see that it remains in the exact centre of the concrete compass rose. The pusher, known as the "goose" is backed away before each measurement is made.

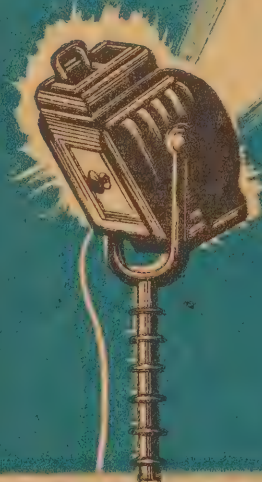
Ⓢ Frequent checks like these are essential to aircraft safety, particularly on long hauls where often navigational aids other than the magnetic compass devices are left far behind. For hundreds of miles these may be the only means the pilot has at his command to keep his machine with its cargo of lives and freight on the true path.

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RESEARCH WORK AND THE FUTURE

Never before, in the history of mankind, has scientific investigation been pursued so relentlessly and with such spectacular results. Things large and small, touching every aspect of our existence, come in for their share of research and investigation.

THE most far-reaching research in science is still that dealing with atomic power. The "breeding" of fissile material, advanced in America and more recently developed in Britain, marks a forward step of of considerable importance.

Striking though such an achievement is, there are few details that can be revealed and little that is immediately of service to ordinary people. What advances are there that help us personally?

One of them, also atomic, is the increased development of radioactive isotopes at Harwell.

These twin-brothers of ordinary chemicals, activated with radioactivity, are used in checking illness, combating disease, testing manufactured products, monitoring machines, and many other applications.

BIG EXPORTS

The latest figures show that Britain now exports 9000 shipments a year to 37 foreign countries — a great increase in range and production over last year.

Another brand of science making great strides is the newly named Ergonomics — the science that measures the limitations of human performance.

This is more than Time and Motion study, for it takes into account the comfort of the worker and the suitability of the atmosphere in which he or she works.

At Oxford this year the third symposium of reports by Ergonomic scientists from several parts of the world was heard. They varied from the "Physiological measurements of work load and work conditions in a steel factory" (from a Swedish investigator) to "The measurement of energy expenditure of military cadets" (a series of tests by a London scientist).

Not the least important of the new developments arising from Ergonomic research are the specially delicate instruments designed to measure energy expenditure.

MEASUREMENTS

Notably, there are the Kofranyl-Michaelis respirometer and the Muller photo-electric pulsometer. The former was used in difficult surroundings underground to assess the energy rates of miners. How much sweat and toil per ton of coal? Is it necessary?

The progress of true science is rarely spectacular but the Ergonomic approach is making life and work easier by the elimination of extra stresses imposed by unsuitable postures or the adverse environment or temperature.

Rest periods at scientifically arranged intervals will enable a worker to do his best with the mini-

mum fatigue. A very different solution from the usual "let us see how much production we can obtain, without regard to the human element", attitude.

Yet, to deal with the advances of science is not easy. The news of today may well have been 10 years in the making—and the modest monograph hardly noticed in a scientific journal this month could be an astonishing revelation to our children's way of life.

TITANIUM

The former case is well exemplified by Terylene, the artificially created fabric recently released for public use; a second example might well be the modest achievements to date with the use of titanium.

The ore of this metal was first found in Cornwall, by one of those inquiringly scientific clergymen with which England was once so rich.

Since that time titanium compounds have been widely applied, but the pure metal has been a somewhat elusive substance. The major problem was that, when liquid and at high temperatures, the molten metal "sucked up" oxygen and became brittle when solidified.

When molten, it dissolves almost every substance with which it comes in contact.

Both these riddles were solved and 99 pc pure titanium metal was made in ingots by Imperial Chemical Industries.

Here is a metal of the future, which may prove rustless, stainless, less than twice the weight of aluminium, and twice as strong as steel. It can stand great heat and its first practical use will be in jet-engines. Later, who knows, it may be in space ships!

by Prof.

A. M. Low

How do the chemists keep it molten while preventing it from "eating" its container? The answer is one of those simple but ingenious devices of physical chemists.

They processed molten titanium at 1700 degrees in a copper crucible that melts at 1100 degrees—by using an electric arc inside the molten mass and constantly running cold water round the outer jacket.

The Australian Scientific and Industrial Research Organisation is forecasting an immense titanium industry for Queensland. The rutile

sands lying along the Queensland coast contain a wealth of metallic ore.

This organisation is now perfecting an electrolytic method of producing the metal—said to be quicker and cheaper than present chemical processes. From this we may receive crash-proof cars, lighter ships, stronger cycles. And not a spot of corroding dust in all!

Let us turn to another branch of science—the study of Nature itself. At a conservative figure we might say that £50-million worth of damage is done annually in the world by termites.

It is a problem worth tackling and its investigation reveals an organisation in incredible totalitarian order, workers, soldiers, kings and queens keeping strictly to their individual tasks.

Now Dr. S. H. Skaide, president of the Royal Society of South Africa, has made a film of termites at home; a film made entirely in the dark of termite colonies.

TERMITES

Dr. Skaide holds the theory that the queen lays only one type of egg, but the varied members of a colony grow from this type by specialised feeding. Here is a secret of Nature—breeding by diet—of great scientific interest, and the film may open the way for us to learn something basically constructive as well as a means of destroying the termite which causes the damage.

From these minute creatures to the astronomical—science is advancing on all scales. The most recent research at Mount Palomar, where the 200in telescope was brought into use in 1950, reveals that the observable universe has been doubled since 1948. We can now "see" a distance of 2000-million light-years.

This fact, astonishing as it is—perhaps too vast to be appreciated—will mean little except to another astronomer.

Yet, perhaps a glance at the heavens now and then would remind all of us that time and space are so infinite that this little earth might well be more humble.

PRACTICAL SCIENCE

Practical science is also stepping forward—expanding like the universe. The Hydraulics Research Station has larger premises at Wallingford, for the National Physical Laboratory at Teddington is proving too small for the testing of tidal and river experiments.

There are now two-wave basins, 125ft by 80ft, both larger than that at the original N.P.L.

In one of them a model of Lyttelton Harbor, New Zealand, is being studied. The harbor requires to be

(Continued on Page 103)



Our everyday bread owes its lightness to the yeast bacteria which are an essential part of its production. These bacteria are extremely valuable.

your body by stealth and robs you of your health". Rather good, eh!

It should be worthwhile putting a patent medicine on the market just so the rhyme can be used in the advertising. "Watch out for that flu germ! He enters your body by stealth and robs you of your health". Play safe. Keep him at bay with Walters' flu destroyer, containing the wonderful additive C.A.W. Keeps you sparking on all plugs!"

Long before germs were properly understood they were used to support a notion that life was generated spontaneously in some magical way. The protagonists of this theory had some very wonderful theories. One scholarly fellow went as far as to reckon that if some old rags, some cheese or grain were placed in a dark, quiet corner it would be certain to eventually produce a flourishing family of mice.

EARLY IDEAS

Likewise, if some meat were placed in an open jar, a good family of maggots would be generated spontaneously. Again, if some beef tea was placed in a closed jar and hermetically sealed, it would in time become alive with tiny animalcules as they were then called. The "success" of this spontaneous generation was proved by the rather foul smell which accompanied the presence of the animalcules.

Later on, as no mice developed from rags and cheese, the supporters of the theory of spontaneous generation became a little less enthusiastic.

ABOUT GERMS GOOD AND BAD

Bacteria, moulds and germs are not always the "villains of the piece". On the contrary, they often play an important part in modern industrial processes and some of the comforts of our modern age would not be possible without their gentle attentions.

To many people a germ is some fearsome creature designed to provide as much discomfort as possible to the human frame. It is blamed for all manner of evil things, including many illnesses for which it is not responsible at all.

FOR AND AGAINST

Do not think for a moment that I am entering into a defence of germs. I do not propose to become the secretary of the Germ Defence League of Australia or any other such organisation.

But there are germs—and Germs with a capital G. I am against the former kind and most emphatic-

ally FOR the latter, for reasons which will become apparent later on.

Now a "crook" germ is one which has no conscience at all. He enters your body by stealth and robs you of your health. That is an unintentional piece of poetry which I think is rather good.

Let's have it again. "He enters

by *Calvin*
Walters

It was also discovered that a piece of gauze tied over the mouth of the meat jar was effective in preventing the "spontaneous generation" of maggots. But it was also observed that a mother blowfly which landed on the gauze, having been attracted to the decaying meat by whatever attracts a mother blowfly, laid her eggs thereon. When these eggs hatched, lo and behold, there were the little maggots on the gauze.

GERM RESISTANCE

One by one the theories of spontaneous generation were broken down and it became known that the putrefaction of the meat and

beef tea were caused by minute organisms always present in the air and which later became known as microbes, germs or bacteria.

A germ is a headless, legless, armless, stemless, rootless, leafless living body. It is completely sexless, poor thing! It is a single cell which multiplies by dividing in two. Each half divides again and so on indefinitely until one cell may eventually become millions.

This latter property is the one which makes it so hard to deal with when it decides to invade the body. If the body cannot, by reason perhaps of a lowered resistance, deal with the germs as fast as they multiply, then it is in for a lot of trouble.

An outstanding feature of a germ is its ability to accomplish work quite out of proportion to its size. Remember that a germ may be only about one-twenty-five-thousandth of an inch in diameter.

This ability to perform an enormous amount of work is, of course, due in part to the rapidity with which it multiplies.

But it is really bound up in surface area. Nature is very fond of dividing work units into a number of individual units in order to increase the surface area.

This is a very interesting and surprising matter and worth going into a bit.

SURFACE AREA

It is a well-accepted principle in biology that the amount of energy required to maintain life varies in proportion to the surface area of the body as distinct from the volume of the body.

A grown-up person requires a proportionately less amount of energy to maintain his health and well-being than a baby. Likewise an elephant requires proportionately less than a cat.

A germ has a greater surface area in proportion to volume than a man and therefore requires a much greater use of energy than a man to maintain its life.

How nature extends the surface area in order to increase the function of energy is well illustrated in the brain, where the surface is not just an unbroken round surface but a series of convolutions and folds. This increases the surface area enormously.

BLOOD CORPUSCLES

Likewise the total volume of the lungs is a mere 400 cubic inches.

But they consist of millions of minute sac-like cavities called alveoli, each of which is lined with a membrane through which a thin layer of blood passes. It has been estimated that the total surface area of these alveoli is about 100 square yards. This is an enormous surface area to be contained in something measuring only 400 cubic inches in volume.

It is a very ingenious scheme in order to expose as great a volume of blood as possible to the action of the inspired air in order to feed oxygen to the tissues.

Again we have the example of the blood corpuscles. There are about 27-millions of millions of red blood corpuscles in a man of average size. They would just about fill a pint

measure. Yet the surprising thing is that the combined surface area of the corpuscles is about 4000 square yards.

This has been engineered this way in order to allow a great surface area to be exposed to the life-giving oxygen of the lungs.

A cube of wood measuring 10 inches on each edge has a total surface area of 600 square inches and a volume of 1000 cubic inches. If it is divided into smaller cubes measuring only one hundredth of an inch on each side we would get one thousand million cubes.

The total volume of these cubes would still be 1000 cubic inches but the combined surface area will be 600,000 square inches.

RAPID MULTIPLICATION

As a microbe is very much smaller than red blood corpuscles or the small cubes it will be seen that the combined surface area of the same volume of microbes as red blood corpuscles must be exceedingly great.

Thus it is that the ability to multiply rapidly and their great surface area in proportion to volume gives germs the capacity to bring about changes in their surroundings of a magnitude out of all proportion to their size.

This is readily evidenced by the rapidity with which milk sours in warm weather or a dead animal decays and disintegrates.

It will thus be seen that we have in bacteria a force of considerable magnitude. When this force is har-

nessed to a useful end it can be most useful.

There appears to be many more bacteria of the "good" type than there are of the "bad" type. We can call them "goodies" and "baddies".

We won't worry about the "baddies" here but will concentrate on the "goodies".

The quality of bread depends a great deal on the yeast with which it is made. Yeast is a microbe of the fungus type. It ferments the dough and, in doing so, creates a gas which gives rise to the spongelike nature of the loaf. Yeast also attacks the sugar in the dough, predigests the protein and renders the bread palatable.

Yeast is also used in the fermentation of beer and other fermented beverages. Here the yeast attacks the sugar in the liquid, with the consequent production of alcohol and carbon dioxide gas which aerates the beer.

MORE GOODIES

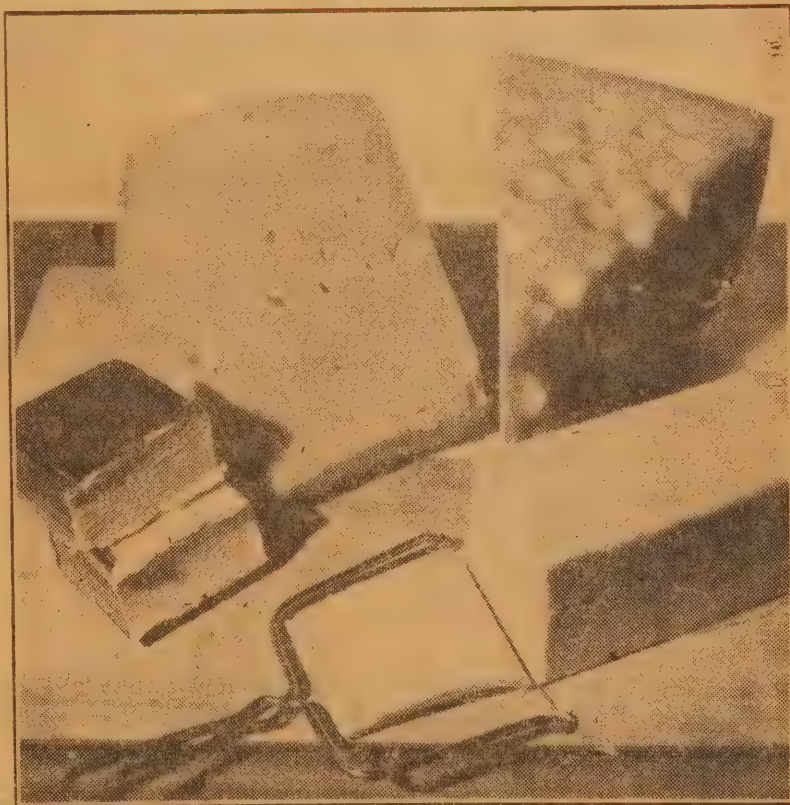
(Whether yeast is a "goodie" or a "baddie" when used for the production of beer is a point long debated.)

In the manufacture of cheese the milk is curdled by the addition of rennet or acid. This curd is calcium paracaseinate, a casein salt.

The curd is processed and moulded into cheeses. These are stored in darkened rooms and allowed to ripen.

Ripening is dependent on the action of a germ called lactic acid

—CHEESE NEEDS BACTERIA TOO!



And cheese depends on the activities of bacteria for its many forms and flavors.

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bacillus. Ripening is really a process of decomposition and sometimes is aided by other germs which give a characteristic flavor to the cheese.

The manufacture of vinegar depends on the action of the acetic acid bacteria. Vinegar may be made from fermented malt, cider, fruit juice, molasses or anything containing sugar.

Acetic acid bacteria exist in the air so that all that is necessary is a supply of air and some fermented juice containing alcohol.

In practice the alcoholic liquor is trickled through a tower over a heap of wood shavings which hold the acetic acid bacteria. As it is acted upon by the bacteria and air it changes to vinegar and is caught in a tub at the bottom.

LINEN PROCESSING

Without the action of germs we could not have that wonderfully fine linen with which some of our fabrics are made.

The linen threads are made from the spun fibres of the flax plant. To separate the fibre from the other unwanted fibres in the stalks of the plant would be difficult without the aid of certain bacteria.

The liberation of the fibres is called "retting" and consists of placing bundles of the ripe flax where they can be exposed to the action of water infected by the necessary germ. This germ digests the gummy stalks but doesn't attack the fibres. After a time the fibres can be readily separated by pulling through combs.

The tanning of leather is another process which is dependent on the action of bacteria.

There are three layers of skin in an animal. The middle one is that used for leather making. The two outer layers are removed by soaking the whole hide until soft whereupon the softened outer tissue is set upon by bacteria which digest them thus making their removal an easy matter.

Sometimes the unwanted layers are removed by soaking the skin in a lime solution. The lime must then be removed. This is easily accomplished by means of acid solutions. For this a bran bath is made. Purpose of this is to provide food for certain bacteria which produce acids. The hides are soaked in this and the acid produced by the bacteria neutralises the lime.

TANNING METHODS

The acid produced is lactic acid and it has been found more economical to produce the acid by means of bacteria rather than to use chemically prepared acid. In addition the slow production of the acid by bacteria is more beneficial for the hides.

The hides are subsequently suspended in a bath of tan bark. The scouring of this bark is brought about by bacteria and is a necessary process for the proper manufacture of leather. No other process has been yet discovered which will replace the microbe in the making of leather.

During World War II the rubber shortage brought about the manufacture of synthetic rubber. One important ingredient for this is butyl alcohol. This is an expensive chemical to make. Here again germs came to the rescue. Peculiar germs called butyric acid bacteria are capable of producing butyl alcohol in abundance by fermenting starch.

ELECTRONIC GUNFIRE FOR ARMY



An electronic gunfire effects unit built by 2UE engineers to achieve greater reality in radio productions has attracted the attention of the Army. Recently the St. George Regiment tested this unit under battle conditions during manoeuvres. Senior officers were enthusiastic about the tactical training potential of this equipment and further trials will be carried out next month. Mr. Murray Stevenson, a director and Chief Engineer of Radio 2UE, explained that the sound effect of a single gunshot in the past had proved to be the most difficult sound effect to achieve in radio production, both for realism and for timing. This had resulted in many hours of costly overtime for entire casts and technical staffs as well as wasted recordings and schedule delays. In addition to the noise of gunfire, the unit can produce the sound of a ricochet when required. Our picture shows the Army using it during tests.

Hence without germs we would have had no cheap artificial rubber.

It has been said that, but for the bacterial process of producing acetone, the Allies would not have won World War I. Acetone is a highly important chemical in the manufacture of explosives.

Acetone is produced by the action of a germ on sugar. This also produces a chemical called butanol. Acetone is a by-product.

Today this process has been replaced by the "cracking" of petroleum products.

The preservation of fodder for cattle in silos depends on bacterial action. The fodder is filled into concrete structures so common in the country. When filled the silo is loosely covered. The bacteria in the fodder immediately get to work and start a fermentation process. Carbon dioxide gas is liberated and lies in a layer over the fodder. The bacteria so alter the stalks of fodder that they will keep for a long time without rotting.

SAUERKRAUT

For those who like sauerkraut it may be surprising to learn that it owes its flavor to certain germs acting on the cabbage and fermenting it. Certain chemicals are formed namely lactic, acetic and succinic acids, ethyl alcohol, manitol and other chemicals. It is to these that sauerkraut owes its flavor and all due to bacterial action.

In fact, sauerkraut seems to be a chemical and microbial storehouse.

I don't think anybody eats it unless they have to. I think it must be eaten by the same people who like their poultry hung up to a rafter for several weeks before cooking.

To write about the beneficial action of bacteria on soil would require a whole volume. The condition of soil depends almost solely on the action of bacteria, without which agriculture could not survive.

Then we have the romantic story of the great life-saving drugs so often told. Penicillin, aureomycin, streptomycin and so on. These are all produced by fungi, a type of bacteria. Think of the vast benefits these have conferred upon mankind.

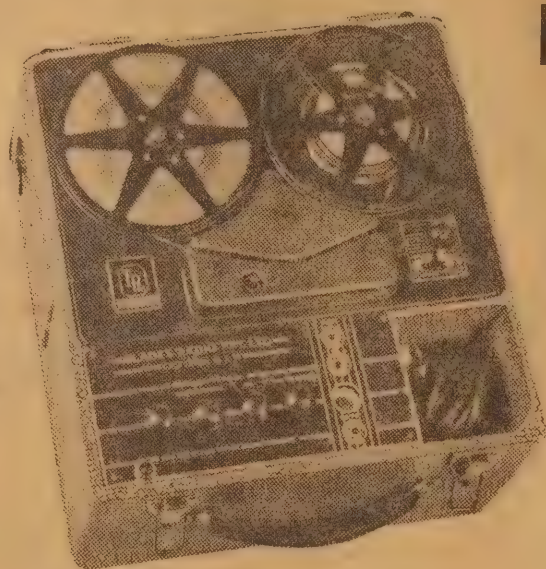
MAKING SULPHUR

A most promising discovery of recent times is the fact that a certain microbe can reduce sulphates in the soil to sulphides. From this sulphide can be made sulphur dioxide, hydrogen sulphide and elementary sulphur.

The importance of this to industry is almost incalculable. Sulphur is used extensively in the making of sulphuric acid, perhaps the most important acid in industry.

So, from the few facts I have brought forward, it will be seen that the microbe is no always a villain. From its ability to multiply rapidly and the subsequent great surface area available, it works for us very efficiently, quickly and economically.

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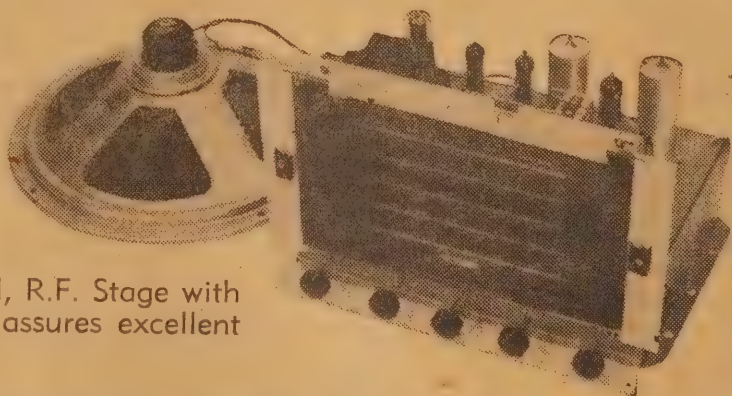
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Technical Review

DAYLIGHT RADAR SCREEN HOLDS IMAGE FOR AN HOUR

A radar viewing screen capable of retaining for several minutes a picture so bright that it can be clearly seen even in brilliant sunlight may result from a new electron picture tube developed by a research team at the David Sarnoff Research Centre of RCA at Princeton, N.J.

THE tube has been designed as a simple electronic tool for the direct daylight viewing of radar in an aeroplane cockpit or on the bridge of a ship.

Today, airborne or marine radar screens are hooded to prevent daylight from obscuring the relatively dim images that appear and, even under a hood that cuts out all daylight, the viewer may have to wait two or three minutes before his eyes adapt themselves to the low light level of the radar image.

A distant cousin of the television kinescope, the new tube was developed by RCA scientists under a United States Army Signal Corps contract. The development team included Dr. Max Knoll, H. O. Hook, and Dr. R. P. Stone, all of the Princeton laboratories staff.

BRIGHTER THAN TV

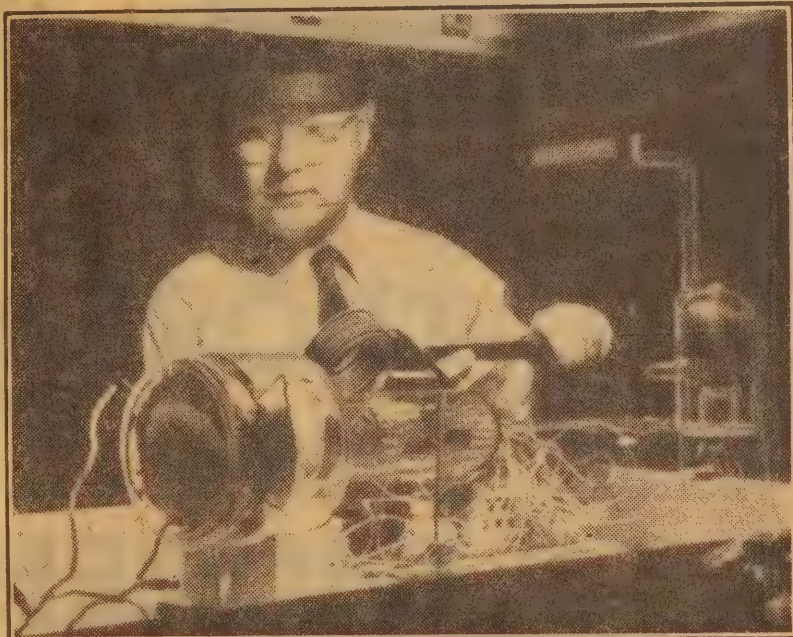
The tube is able to present pictures five to 10 times brighter than those on a standard television kinescope, or picture tube, and to retain a half-tone image on the screen for some 30 seconds without any deterioration, or up to several minutes in useable form.

In radar scanning reproduction, the viewing duration needs only to be about 10 seconds before a new picture is to be displayed.

In other applications where half-tone reproductions are not required, such as the display on an aeroplane instrument panel of continuous visual instructions from a ground station, a single black-and-white image can be held on the tube for an hour or longer.

The RCA research team said these characteristics of the tube point to possible use in airborne facsimile systems, oscilloscopes, and wherever a bright electronic picture of transient data needs to be held over extended periods for viewing or photographing.

In appearance and operation, the



Dr. R. P. Stone, a member of the development team puts the finishing touches to one of the new tubes before testing.

developmental tube is a small approximation of the standard television picture tube. Like the latter type, it uses controlled streams of electrons to paint a picture on a phosphor-coated screen on the face of the tube. However, to present exceedingly bright pictures and to retain them on the tube face for minutes or longer, a number of different techniques were developed.

THREE GUNS

In the neck of the tube are three electron guns, each producing an independent stream of electrons directed toward the tube face. One of these, similar to the electron gun in a standard kinescope, "writes in" the picture. The second gun floods the viewing area with a continuous shower of electrons, producing the picture seen on the phosphor screen. The third "erases" the retained picture when it has served its purpose.

In a standard television picture tube, the writing beam directly scans the phosphors on the viewing screen, making them glow in a pattern that creates the picture.

In the new storage tube, however, the writing beam does not produce the picture directly—it scans a special storage grid mounted about one-tenth of an inch behind the phosphor-coated screen. The grid is a fine-mesh screen (160,000 openings per square inch) supporting a thin insulating film.

As the writing beam scans the insulating film, it builds up local electrical charges whose intensity varies with the pattern of the picture signal.

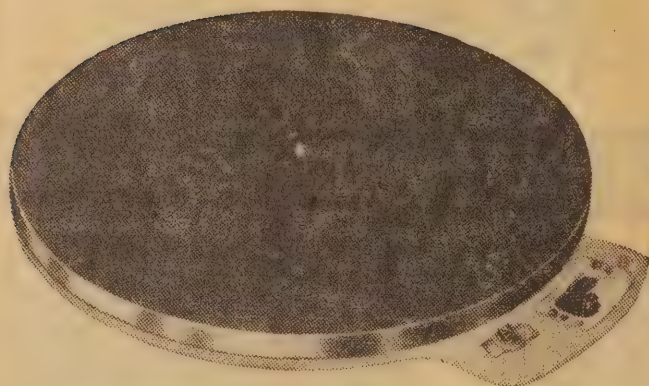
As the picture is thus built up on the grid, the continuous shower of electrons from the second gun passes through the charged openings of the grid, acquiring as it passes the pattern built up at these openings by the writing beam. The shower, or "flooding beam", then strikes the phosphor coating of the viewing screen, creating the picture for the observer.

PERSISTENCE

Because the flooding beam continues to pass through the charges built up on the grid, the picture remains for some time on the screen.

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842 Hay Street, Perth

Interstate Distributors

SOUTH AUSTRALIA

L. S. WISE & Co.,
196 Gillies St., Adelaide.

VICTORIA

SIMON GRAY
Radio Division, 28 Elizabeth St.,
Melbourne, C.I.

The erasing beam, controlled either by the viewer or automatically by associated circuits, may be brought into play at any time to clear the tube face for a new picture. It does this by altering the charges on the storage grid in such a way that the flooding beam is blocked at all points, preventing the shower of electrons from striking the phosphors of the tube face.

A non-electronic analogy to the process can be found in coating a window screen with heavy paint and holding it above a table in the sunlight. If a pattern is traced on the screen with turpentine, clearing paint from some of the holes, sunlight may pass through and create an image of the pattern on the table surface. Repainting the screen will cause the image to disappear.

In this analogy, the table represents the phosphor-coated viewing screen, the window screen represents the storage grid, the action of the turpentine compares to the action of the writing beam, the sunlight to the flooding beam, and then repainting to the erasing process.

In its present form for radar application, the tube has a viewing screen four inches in diameter, capable of presenting an image hundreds of foot lamberts of brightness in its high-lighted portions.

To produce this brightness, the tube requires considerably less anode voltage than does the standard television picture tube, largely because of the tube's ability to light every spot on the viewing screen continuously with the flooding beam rather than intermittently as is the case in the TV kinescope.

HAS THE PROPELLER A FUTURE?

Now that the jet age in aviation is an accomplished fact, now that fighters, bombers and even the first jet airliners are able to cruise at speeds of about 500 mph, the future of the propeller might well be thought obscure. Mr. G. C. I. Gardiner, director and chief engineer of De Havilland Propellers Ltd., seeks to put the question in perspective.

OUT of the controversy between the advocates of the jet and the propeller there has emerged the realisation that the propeller, allied to the turbine engine, is pre-eminent for certain duties.

It was always appreciated that the propeller would continue to power the lighter types of aircraft and the relatively slow, heavy transports, but the immediate success of turbo jets is evidence that the propeller power plant is also a correct choice for civil aircraft of this type.

PROPELLER REFINEMENTS

Advances in design have made the modern propeller an intricate and versatile mechanism, and a system of manual control of propeller pitch for ground running is being developed.

LOW-DRAIN HEARING AID

The modern hearing aid is vastly different from the cumbersome devices used a few years ago. Miniaturisation and new developments have reduced weight and size to almost negligible proportions.

TRANSISTORS have distinguished themselves in many fields, but in none more than that of hearing aids. Their small size and low power-supply demands have produced a complete new line of ultra-compact instruments. Even more important, the low power requirements have made hearing aids vastly more economical to operate.

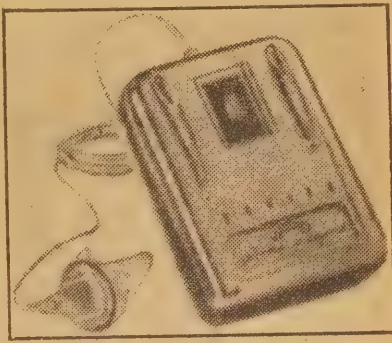
Since a hearing aid user may keep the device on during the wearer's whole waking period, battery expense with old-style instruments is no small item.

One of the latest, the Zenith Royal-T, uses a single 1.5-volt cell, which will last approximately one month. This aid uses three CK-718 PNP junction transistors in a grounded-emitter circuit, with special magnetic microphone and earphone. A phone magnet makes telephone conversations easy.

SLIDE SWITCH

A small slide switch on the side of the case switches from the microphone to the built-in inductive type telephone pickup coil. Sounds are picked up by holding the hearing aid close to the telephone receiver or close to the bottom of the cradle.

The tone-control switch is a special type that is a bit more complex than the diagram illustrates. It is set into the top of the case on the opposite edge from the volume control. In



The Zenith Royal-T hearing aid.

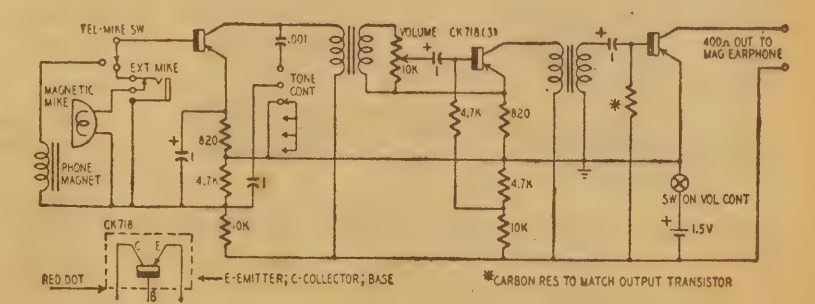
the diagram the switch is shown in the full-range position. In the next position, high, the 1-uf capacitor is grounded. In the medium position the 1-uf and the .001-uf capacitors are both grounded. When the switch is turned to low the .001-uf capacitor is grounded while the 1-uf unit is not, although this is not possible with the simplified switch diagram in the manufacturer's schematic diagram, shown here.

The unit also includes a miniature circuit-transfer type jack that is used with an external microphone. The built-in unit cuts out automatically when the external unit is plugged in. —Radio Electronics.



Right, low power requirements of hearing aid permit operation on a single 1.5-volt cell.

Below, schematic diagram of the Zenith Royal-T hearing aid, and layout of CK-718 terminals.



AUTOMATIC RADIOGRAMS

Designed for today ✱

NEW YORKER - C85 ✱



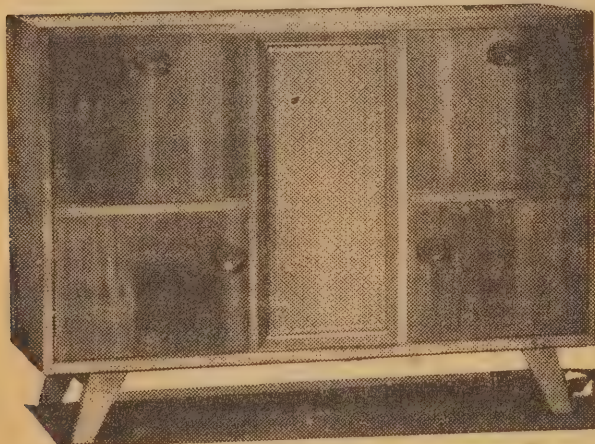
Nowadays people expect both beauty and utility from their furniture. The Calstan C85 "New Yorker" and C79 "Continental" have that simple yet functional design so popular overseas. Finished in really modern high quality honey-toned maple veneer both models are available with 8, 6, or 5 valves.

Special features of the New Yorker—

- Choice of five, six, or eight valve world range receiver.
- 12in speaker of the latest type.
- 3 speed automatic record changer — plays 7in, 10in and 12in records.
- Craftsman-built cabinets in finest veneers.

Calstan combine all the best features of radio engineering & cabinet craftsmanship.

See them at all
good radio dealers



✱ *CONTINENTAL - C79*

Special features of this model—

- 3 speed record changer
- Dimensions: 48in wide x 35in high x 18in deep
- Expanded aluminium grille.
- 2 large storage compartments for records and/or glassware or bottles

A product of the **CALSTAN DIVISION of ZENITH RADIO Co. Pty. Ltd.**
131-133 Palmer Street, Sydney. Phone: FA2157

WORLD'S SMALLEST TV STATION

Most people associate television stations with large scale enterprise, vast studios, and high powered transmitters. But what is claimed to be the world's smallest station has none of these, and yet it supplies programs for more than 15,000 people.

IT operates at the US Air Force base at Limestone, ME, from which is flown some of the world's biggest bombers belonging to the 42nd Bombardment Wing.

It is regarded as a significant experiment which might set a pattern for small television installations likely to be of great future value not only to military posts but in the actual carrying out of military operations.

The maximum coverage of the station is only three miles, which is not surprising for a station with a power of only eight watts.

COULD BE INCREASED

But this power could be increased materially without great difficulty to give appreciably larger range, particularly under conditions which allow favorable siting.

The three-mile range is adequate to serve the somewhat isolated population in the 10,000-acre installation only a few miles from the Canadian border.

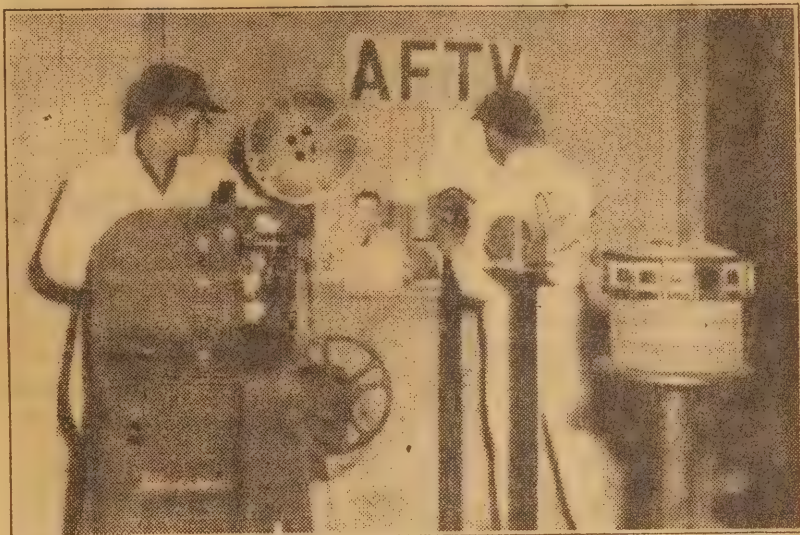
The equipment is based upon special types developed for use in aircraft similar to those operated from the base, in which light weight and easy operation are paramount requirements. The standards are probably not as good as those used for regular TV, but then they do not have to be—an acceptable grade of program is better than none at all.

PROGRAMS

Studios and transmitter are housed in a shack 10ft x 13ft at the top of a four-storey hospital building. Seven men operate the station and programs consist of kinescope recordings of shows originally prepared for the major TV networks.

It also includes three daily live newscasts and twice daily weather man programs. Other subjects peculiar to the station are included, such as flying safety programs and religious services conducted by air force chaplains.

The station is initially on an experimental basis, but it is expected to pave the way for wider use of TV in the normal activities of the fighting services. The equipment was provided by RCA.



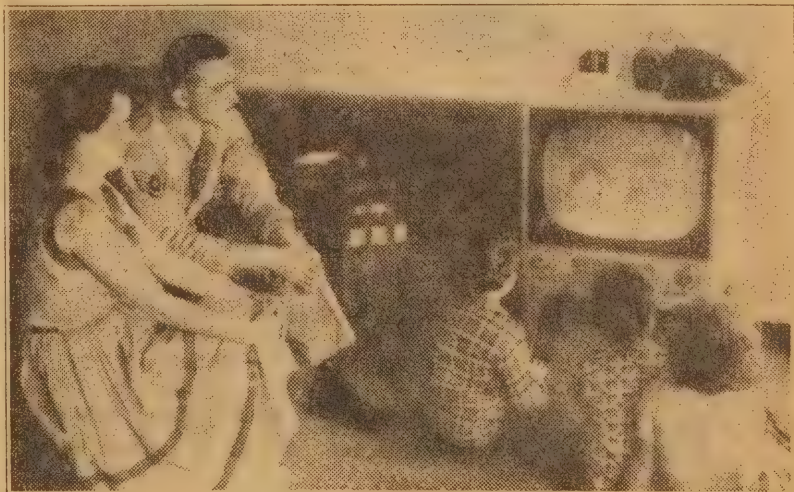
Two of the station staff prepare to show a film recording. The announcer is seen through the window in the background.



The announcer gives a broadcast of news from his tiny office.



A teletype is used to gather and prepare the news which goes over three times per day.



An enlisted man and family watch their own programs.

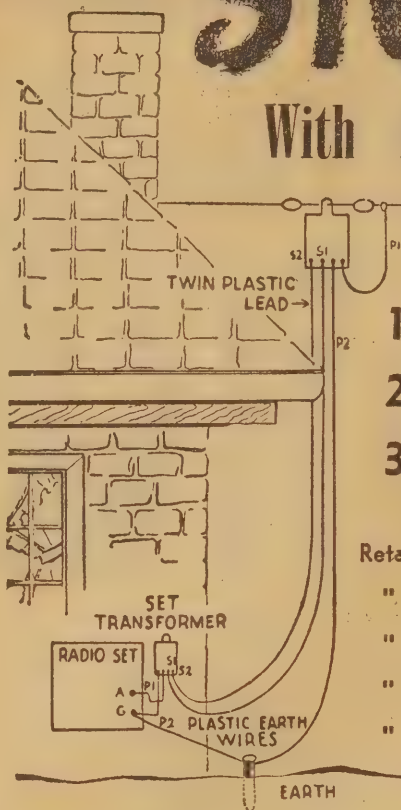
STOP NOISE IN YOUR SET

With R.C.S. aerial and line filters

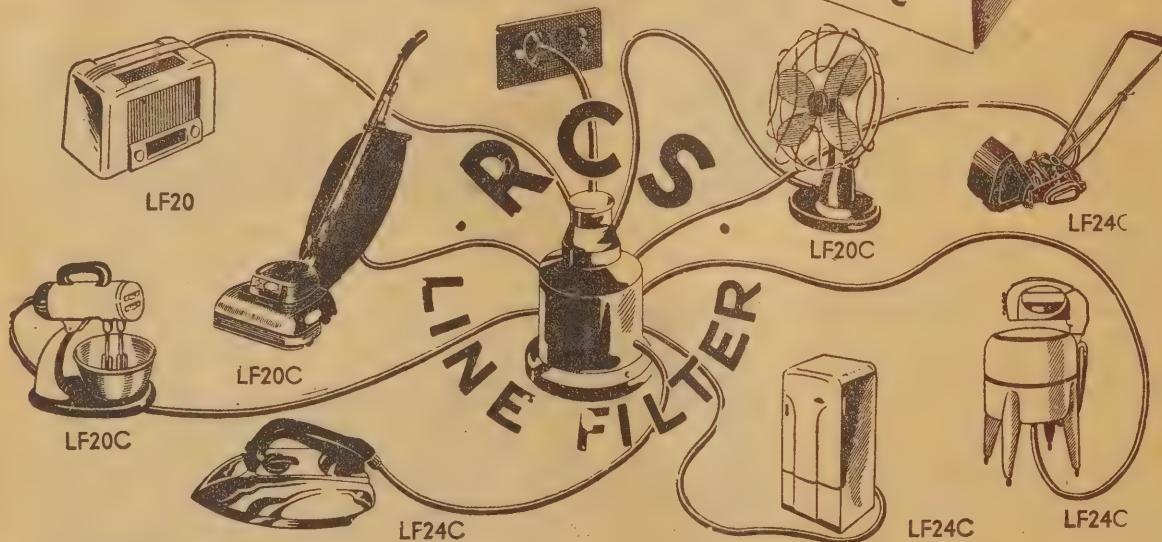
MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

Retail AF21C aerial filter	140/-
" LF20 line filter ..	37/-
" LF20C " " ...	42/-
" LF24 " " ...	50/-
" LF24C " " ...	55/-



CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER



DISTRIBUTORS:—

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R. C. S. RADIO PTY. LTD.

651 FOREST ROAD,
 BEXLEY. PHONE LW 3491

NEWS AND VIEWS OF THE MONTH

Electronic Light

A NEW method of obtaining artificial light, said to be more revolutionary than the fluorescent tube, is predicted by David Sarnoff, chairman of RCA in America.

Some time ago, Sarnoff announced that his firm was working on the problem of new and better lighting, including a method of amplifying light waves which would indeed be revolutionary.

Whether this is included in his recent predictions is not clear. He is more likely to be referring to a method of ionisation of the air which would create a glow.

He said the new development, "electronic light", was a result of television research.

It eventually would bring greater safety in travel, whether on land or sea or in the air.

The light would enable man to see great distances at night, without any blinding headlight glare.

Most of the preliminary work on electronic light would be completed in 1956.

One result would be the reduction of the new bulky TV set to a flat screen on a wall, controlled from an armchair box no larger than a jewel case.

In the more distant future there would be atomic batteries in wrist-watch radios, vest-pocket radio telephones, and electric shavers the size of a penknife.

Space travel ahead

ACCORDING to Dr. Walter Gerlach, deputy chairman of West Germany's Space Research Society,

a "race to the moon" between the US and Russia has begun.

He said German research workers believe the winner—the first nation to set up a space station to watch Earth—will be the master of the globe.

German rocket experts believe that American and Soviet research is so far advanced that space travel is "just around the corner".

Wonder whether it will be as nebulous as the corner television had in sight for so long?

Start with the moon

ON the other hand Dr. Wernher von Braun, pioneer in German guided missiles, said recently that man could land on the moon in 15 to 20 years.

The US could have a fully-manned space station circling the earth in 10 or 15 years.

Dr. von Braun said the US could have the space station if it were willing to go all out on the project.

"It is all a matter of how hard we push it," he said.

Once the space station was established as a stepping stone man could land on the moon in 15 to 20 years' time.

The United States could launch an experimental missile to cruise about the earth "in approximately four or five years".

The "orbital rocket", which would carry instruments and would weigh between 100lb and 200lb, would cost about 100-million dollars (about £44,600,000) he said.

If the orbital rocket were sent up 500 miles it would circle the earth endlessly.

So it would have to be kept "relatively low — some 150 to 300 miles above the earth—and it would finally come back to land.

★ ★ ★

Helicopter service

BRITAIN'S first licence for an international helicopter service has been granted to Silver City Airways, the cross-Channel car ferry firm.

Commercial flights will begin next May.

No passengers will be carried across the Channel until twin-engined helicopters are available.

In the meantime, the firm's single-engined helicopters are likely to carry car spares to the Continent.

On the return flight they will probably be loaded with Camembert cheeses.

The larger helicopters—the firm hopes to be using Fairey Rotodynes by 1957—could carry three cars and 12 passengers.

★ ★ ★

Life on Mars

DR. E. C. SLIPHER, of the Lowell University, one of the world's astronomers who journeyed to South Africa to take pictures of Mars has returned home with 20,000 photographs.

From these he says proof will emerge that there is life on the planet.

Mars this year passed closer to the earth than at any time since 1941.

POPULAR SCIENCE QUIZ

Q. Have scientists produced an element heavier than uranium?

A. According to reports, some Swedish scientists have been successful in producing an element heavier than uranium, the heaviest element occurring in natural state. In the table of elements, uranium is number 92 while the new element is number 100.

An isotope of the new element was produced by bombarding uranium with charged oxygen particles in a cyclotron. The isotope has a half-life of about half an hour. Use of oxygen as a bombarding particle in cyclotrons is a recent process. Such heavy particles as nitrogen and carbon have been used in lieu of helium and hydrogen.

The oxygen ions used in the production of the new element had energies of 180-million electron volts. The bombarded uranium was forced to take on, in one step, the eight protons necessary to change it into the new element 100. The probable mass number is stated as 250. The new element was identified by its alpha activity, about 20

alpha disintegrations of 7.7-million electron volts usually being found.

Q. What is the "eye" of a hurricane?

A. Hurricanes can be produced by conditions of high temperatures and humidity associated with converging winds. The absolutely calm area in the centre of a hurricane is called the "eye".

The eye is fed by warm, moist air currents from both top and bottom. The droplets of water from these warm moist air currents give up their heat through evaporation and add to the hurricane's destructive power.

The earth's rotation contributes to the initial spinning and, because of this, the direction of rotation of a hurricane in the southern hemisphere is clockwise, while in the northern hemisphere it is anti-clockwise.

It has been estimated that hurricanes expend sufficient energy in one day to run all the power plants in the world for several years. Another estimate in different terms is that a hurricane

expends energy at the rate of 500-million million horsepower per second, or the equivalent of "several thousand atom-bombs per second".

Q. What are "cold fronts" in the oceans?

A. As in atmospheric "fronts", where warm and cooler air masses meet, so "fronts" arise in oceans where warm and cold water currents oppose each other. However, atmospheric "fronts" are associated with violent air disturbances whereas ocean "fronts" are areas which teem with animal and plant life and are rich hunting grounds for fishermen.

Surface temperatures, salinity and other properties differ sharply on opposite sides of an ocean "front" and fishermen have long used these fronts to guide them to fish feeding on plants and animals swarming in the narrow frontal zone, which is marked by lines of kelp and foam. A long, sharply defined and almost permanent oceanic front has been discovered near the equator.

An Announcement!

So enthusiastic has been the reception of the new

"Q-PLUS" Pre-Fab Tuning Units

that it has been decided to extend the range.

Of importance to stockists is the news that all three RF Pre-Fab Units are on the same size chassis—and are thus interchangeable with the main chassis.

FOR DECEMBER RELEASE

"Q-PLUS" Type QWR5, Pre-Fab Band Spread Unit with RF Stage

What is "Q-PLUS-PRE-FAB"

Many home constructors lack expensive test equipment, or if they are only building one or two sets the outlay would exceed the value for the set they are building—Q-Plus designers have recognised this and set about to help, and the response we have met has proven our theory to be correct.

When you buy a **Q-Plus Pre-Fab** unit you buy virtually the whole front end of a receiver—already wired and set tested.—All RF alignment problems have been solved.—You simply add dial, valves, IF audio stages and presto! A set equal or better than most commercial sets.

DON'T BE MISLED—

Only "Q-Plus" market this pre-aligned unit—apart from being wired and aligned remember your price includes gang condenser, valve sockets, by-pass condensers, resistors, terminal strips, hardware, rubber grommets, etc, etc.

NOW THE "PRE-FAB" FAMILY IS THREE

Soon it will be four and even five.

DWRP5	—A Dual Wave, Pre-Fab Unit, RF Stage for 6AE8, Converter 6BA6, RF Stage	£12/12/-
TWR5	—A Triple Wave, Pre-Fab Unit, RF Stage for 6AE8 Converter, 6BA6 RF Stage	£13/13/-
QWR5	—A Four Band, Pre-Fab Unit, RF Stage for 6AE8 Converter, 6BA6 RF Stage	£14/14/-

Manufactured and Guaranteed by

R. W. STEANE & CO. PTY. LTD., — Auburn, Victoria

Dr. Slipher's photographs were made with the 27in telescope of the Lamont-Huey Observatory at Bloemfontein, and show great blue-green markings.

"Mars is alive," he is quoted as saying. "It has to be.

"If things did not grow there, changing with the seasons, dust from the red deserts of Mars would have settled long ago over its entire face.

"The planet would be all one color."

★ ★ ★

Saucers from Mars

FRANCE has countered Britain's flying bedstead with a wingless flying cigar and a flying barrel.

Both have made successful radio-controlled vertical take-offs and landings under secret conditions.

This news has set all French pro and anti-flying saucer factions off in a new whirl of controversy.

For the past six weeks, reports of Martians and flying saucers, flying cigars, flying cups and flying barrels have been so widespread in France that their true origin has become subject of passionate nationwide debate.

Analysis of these reports has established that the average Martian has eyes like pigeons' eggs, hairy face, leathery skin, and a helmet

RADIO AND HOBBIES has

a staff vacancy for a technical journalist with a sound background and the ability to handle projects and write articles on radio. Apply in writing with copies of references to the Editor, Radio and Hobbies, 60-70 Elizabeth St., Sydney.

with green and blue lights on it.

He averages in height from 3ft to 5ft.

Also, he carries a paralysing gun and appears very nervous.

Anti-saucerites have been gradually winning with repeated proofs that story after story has been due to a kind of mass hysteria.

But the victory for pro-saucerites comes with the announcement that German rocket scientist Helmut de Zborovsky has perfected a jet-propelled flying-cigar.

Tests show that full-scale piloted models should be able to climb vertically to 60,000ft in two minutes.

★ ★ ★

Giant cannon

EUROPEAN observers recently had their first glimpse of America's giant atomic 280 mm. cannon at Sennelager, West Germany.

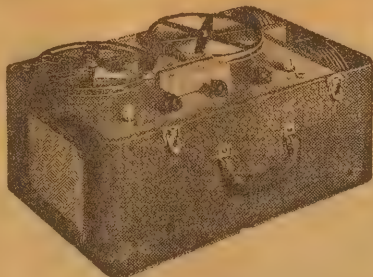
Australian observers were among those who saw a demonstration of the 85-ton gun.

With its two transporters, the cannon is 84ft long. The cannon can fire both conventional artillery shells and shells fitted with atomic warheads.

It is completely mobile and can negotiate corners in the smallest villages.

The cannon uses one gallon of fuel a mile. It can reach a speed of 35 miles an hour.

NOTE: NEW TELEPHONE NUMBERS: BM6138, BM2350



'NOVA'



THREE SPEED
(7½-3¾ and 1⅞ ins.)

KITSETS — DECKS — RECORDERS
FIRST TIME ON ANY RECORDER THE NEW
NUMBER PLACE-FINDER

Gives exact location of any spot on the tape anywhere on the full FOUR HOURS of recording.

One-Knob Control: A child can operate it.

TAPE-RECORDING HEADS:—

half track or full track, hum balanced, single hole mounting, 11,000 c/s at 7½in, 8000c/s at 3½in and 3500c/s at 1 7-8in., £4/10/6.

Special magnetic heads in miniature with film guide for 8, 9, and 16mm Film SINGLE SCREW MOUNTING, £7/9/-, including Shield.

REMEMBER:—'NOVA' is the ONLY firm making commercial tape-equipment, used in recorders and Tape-grams available to the self builder in Kitform.

TELEPHONE AMPLIFIER AND PHOTOFLASH KITS AND COMPLETELY BUILT-UP UNITS.

As described in Radio and Hobbies.

TRANSFORMERS

Before purchasing any transformer, choke, etc., contact 'NOVA' for a quotation on your needs. We will manufacture any transformer to your specification within a few days.

From Little Hearing-Aid Transformers to the ORIGINAL 'WILLIAMSON' or 'LEAK' on English, 28A Supersilcor.

NO JOB TOO SMALL! NO JOB TOO LARGE!

All types of transformers to our customers' specifications.

VARIABLE TRANSFORMERS, RE-WINDS.

HURRY!! THERE ARE STILL SOME
BARGAINS LEFT!!

'NOVATAPE' offer a selection of items at Reduced Prices.

Demonstration RECORDERS, DECKS, MODELS, HEADS, MOTORS, PARTS.

These are definitely worth the money and are released to the readers of 'R. & H.' at Greatly Reduced Prices to make room for more stock for our ever-increasing production.

PLEASE SEND S.A. ENVELOPE WITH 3d STAMP for DETAILED LIST. All items must be sold immediately.

'NOVA' TAPE-TO-DISC SERVICE

'NOVA' will make Standard and Microgroove Records of any tape. Please send S.A. envelope with 3d. stamp for details.

Terms on low deposit.

For further details
contact your dealer or

"NOVA"

311 SUSSEX ST., SYDNEY

NOTE: New telephone
numbers:

BM6138 — BM2350

OPEN SAT. MORN. AND
WEEKDAY NIGHTS.

-----CUT OUT HERE-----

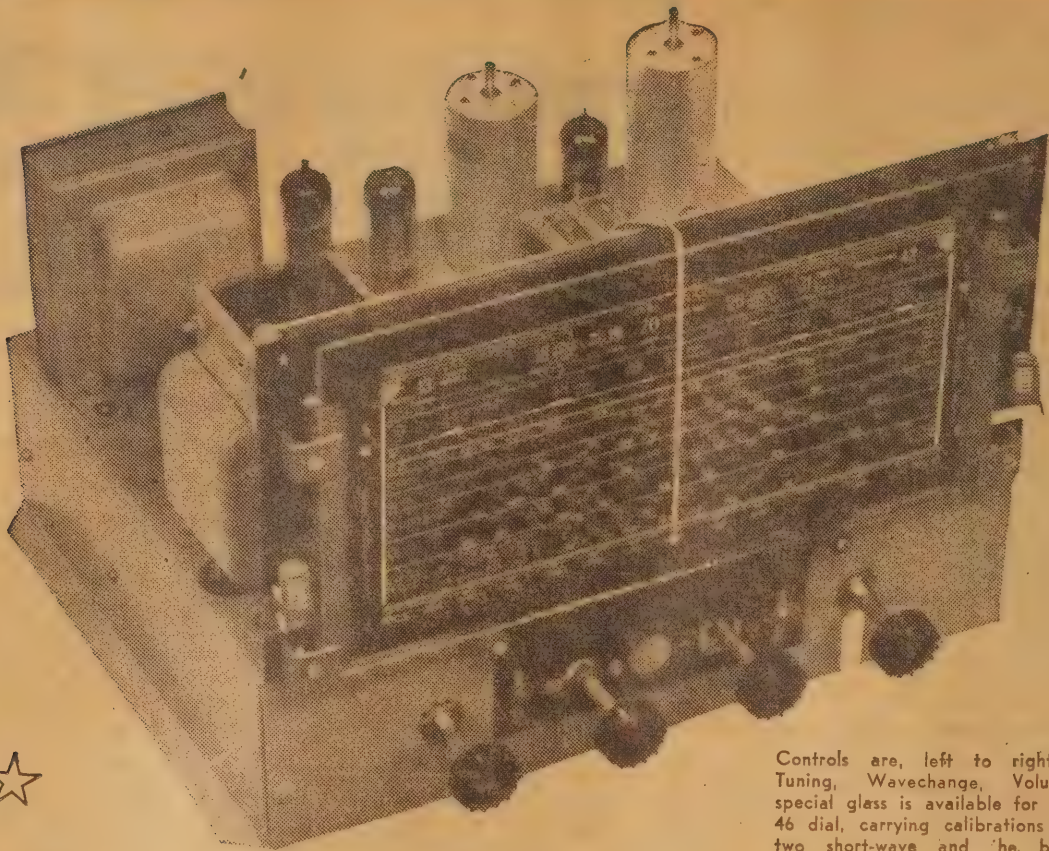
12/54

Please send without further obligation, details of.....

NAME.....

ADDRESS.....

I enclose LARGE self-addressed envelope and 6d. in stamps.



Controls are, left to right, Tone, Tuning, Wavechange, Volume. A special glass is available for the USL 46 dial, carrying calibrations for the two short-wave and the broadcast band.

POWERFUL 3-BAND RECEIVER

Here is an ideal set for the DX fan—a high performance job with an RF stage and a tuning range which takes in the broadcast band and the complete short-wave spectrum from 2.8 to 23 megacycles. You buy the set's entire tuning system as a packaged unit, pre-aligned before it leaves the factory.

THIS new set represents, in fact, just the reverse approach from the one we featured in our last issue. It's intended, of course, for a different class of listener—or rather for listeners with a different outlook on short-wave reception.

Last month's set, you may remember, made a big feature of the band-spread idea.

By restricting the coverage to the main international broadcast bands, we showed how it was possible to spread these right across the dial, making it delightfully simple to tune in the stations using them.

Such a set would seem to be the natural choice for folk—particularly new Australians—who may well have as much interest in overseas stations as we have in our own local programs. The fact that the set does not cover frequencies allotted to amateurs, shipping services, &c., is of no consequence to them.

And that, of course, is where this type of listener differs from the traditional DX fan.

Whether listening on broadcast band or short waves, the DX fan gets his greatest pleasure from searching for new signals, identifying them, listening for a while, puzzling his way through language and code problems, watching the seasons come and go, the bands open and close, and so on!

The receiver he needs must be as sensitive and selective as possible, and cover the complete frequency

spectrum. The fact that it might be more critical to tune, as a result of this wide coverage, is of no great consequence.

So there it is—just a matter of what you want and the way you like it. Some will inevitably turn back to the bandspread idea; others will doubtless see in this new set just the thing they've been looking for.

The set, which we've called the "3-Band Six", is built around a special tuning unit, just recently released.

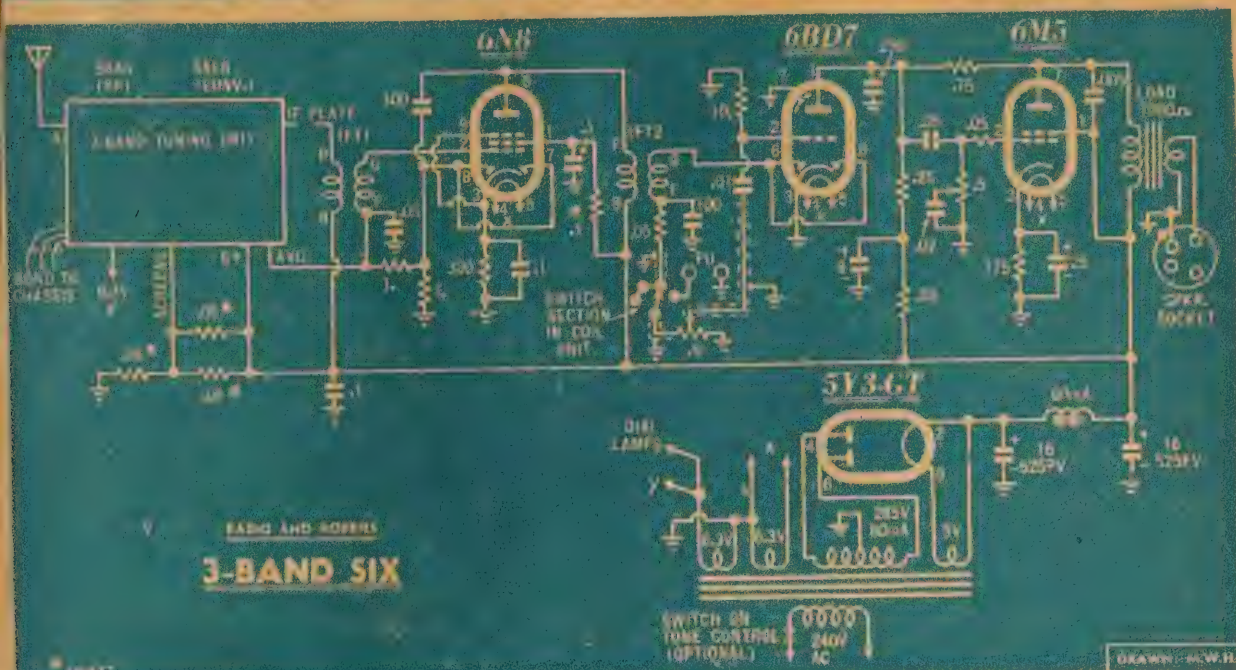
Manufactured by Messrs R. W. Steane ("Q-Plus") it differs from most earlier units in that it is a complete "front-end" assembly. As usual, it contains the wave change switch, the coils and the trimmers.

In addition, however, it carries tuning gang and the RF and converter valve sockets, with all the relevant wiring and components.

You merely build it into a chassis,

by *Neville Williams*

CIRCUIT DIAGRAM OF THE NEW 3-BAND RECEIVER



Here is the complete circuit diagram. The entire tuning end, including coils, switching, gang, RF and converter sockets comes as a separate pre-aligned unit, which is simply bolted into the chassis. The circuit therefore shows only the supply leads to the unit, plus the IF and audio system.

couple the input lead to the aerial terminal and the output to the first IF transformer. You plug in the specified valves, couple up the heater and high tension leads and the "front end" of your set is finished, ready to go.

There's even more to it than that. Since the wiring within the unit does not have to be touched, the manufacturers are able to pre-align and seal the tuning circuit adjustments before the unit leaves the factory.

Unless you have the knowledge and the facilities to re-check their work to your own satisfaction, the alignment can be taken for granted.

Only the IF transformers which, of course, are bought separately, will need touching, and even they should be fairly close to the mark. The idea certainly works out very well.

DX—FIRST TIME

In our own case, the first station we heard after switching on was one of the inland regionals — and this at noon on a summer day from the heart of the city!

What of the cost? Well, that's between you and the manufacturers.

But remember that the price covers the tuning gang and all the components associated with the RF and converter valves. What is more, the finished set will far outperform any ordinary commercial dual-wave.

So much for the idea behind the new set. Its construction naturally involves a few mechanical problems, chief of which has to do with the chassis.

Unfortunately no two coil units seem to be alike, in most cases, the decision to use a particular type involving the design of a chassis speci-

ally to suit it. This one was no exception.

We checked through our blueprints in the hope of finding a chassis that would do, but with no success. The ones that were big enough all seemed to run the wrong way, with the power transformer sitting right where we wanted the RF valve to be!

A new chassis had to be laid out, therefore, and the way we did it

should be clear enough from the pictures. It was bent up from 18 gauge aluminium and there is no reason why any experienced constructor should not do the same.

Ready-stamped steel chassis should ultimately become available, but just how soon depends on those rather nebulous quantities of supply and demand, complicated by strikes, shortages and what-have-you.

PARTS LIST

- 1 Chassis 9 1/2 x 12 x 3 in.
- 1 3-band tuning unit (see text)
- 1 Dial to suit (USL 46, AWA gang, triple-wave glass)
- 2 455 Kc IF transformers (Nos. 1 & 2)
- 1 Power transformer 285 volt per side, 80 mA, 6.3V, 6.3V, 5.0V.
- 1 Filter choke, 80 mA. (see text)
- 1 Speaker with output transformer to suit (see text)
- 1 Octal valve socket.
- 3 9-pin miniature valve sockets.
- 1 Miniature 4-pin speaker socket.

CAPACITORS

- 1 25 mfd 40 PV electrolytic.
- 1 16 mfd 525 PV electrolytic.
- 1 16 mfd 350 PV electrolytic.
- 1 8 mfd 350 electrolytic. (miniature type preferred).
- 2 0.1 mfd tubular 350V.
- 1 0.1 mfd tubular 200V.
- 1 .05 mfd tubular 350V.
- 1 .05 mfd tubular 200V.
- 1 .02 mfd tubular 350V.
- 1 .01 mfd tubular 200V.
- 1 .005 mfd mica.

- 1 250 pF mica.
- 2 100 pF mica.

RESISTORS

- 1 10 meg, 1/2W.
- 2 1 meg, 1/2W.
- 1 .75 meg, 1/2W.
- 1 .25 meg, 1/2W.
- 1 0.1 meg, 1W.
- 3 .05 meg, 1W.
- 3 .05 meg, 1/2W.
- 1 300 ohm, 1/2W.
- 1 175 ohm, 1W.
- 2 0.5 meg potentiometers, one with switch.

VALVES

- 1 6BA6, 1 6AE8, 1 6N8, 1 6BD7, 1 6M5, 1 5Y3-GT.

SUNDRIES

- 4 terminals, 4 knobs, hook-up wire, power flex and plug, 4ft (approx.) shielded wire, 1 8-tag strip, 1 5-tag strip, 1 2-tag strip, small quantity of bare tinned copper wire, nuts, bolts, washers, solder lugs, 1 large grommet, 2 3/8in grommets, small quantity of spaghetti tubing, 2 dial lamps.



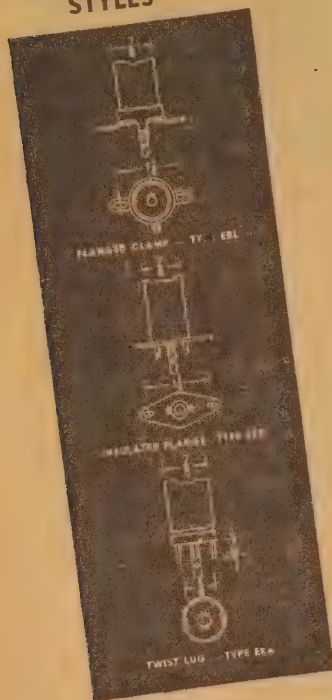
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100	10	12	1½	¼	8	300	350	1½	½
250	10	12	1½	½	16	300	350	1½	½
400	10	12	1½	¾	24	300	350	2½	½
500	10	12	2	¾	16	350	415	2	½
10	25	40	1½	½	8	450	525	1½	½
25	25	40	1½	½	16	450	525	2½	½
100	25	40	1½	¾	8	500	600	1½	½
50	125	150	2	¾	16	500	600	2½	½

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REAR VIEW OF THE 3-BAND SET

For those who may want to make their own, a chassis blueprint will be available in the usual way through the query service. (Price 4/6.)

The tuning unit is designed so that the RF and converter valves are along the right hand side of the chassis when viewed from the front.

The converter plate lead passes out through a hole at the back, soldering to the "P" terminal of the first IF transformer, just behind it. The layout then follows in orderly fashion along the rear edge of the chassis, as seen in the photograph.

The power transformer mounts at the front left-hand corner, just behind the dial. There should be room for any upright 80-milliamp type in this position, although additional holes may need to be drilled, if the unit you choose is not a duplicate of the original.

The 5Y3-GT rectifier mounts just behind the power transformer with the filter choke behind that again, in the rear corner. The one we used is a fairly bulky type, and, once again, there should not be any difficulty in accommodating any other brand of 80-milliamp choke you may buy.

FILTER CHOKE

By and large, the bigger the choke, the more effectively will it reduce the hum level. But, of course, it will be more expensive. If you feel that you can get by with a less pretentious choke, by all means use one.

Placing the choke on top of the chassis, as we have done, means that the output transformer must be mounted elsewhere — either beneath the chassis or on the speaker. The exact position does not matter a great deal.

For a set of this type, we expect that most readers will settle for a standard 12-inch speaker, complete with its own output transformer. The one shown in the underneath photograph is of quite generous proportions and sells at only a fraction the price of a special job.

Placing the transformer on the chassis has the immediate advantage that the plate circuit of the output valve can be wired up permanently. There is therefore less chance of the valve being damaged, if the set is switched on without the speaker being plugged in.

LESS INSTABILITY

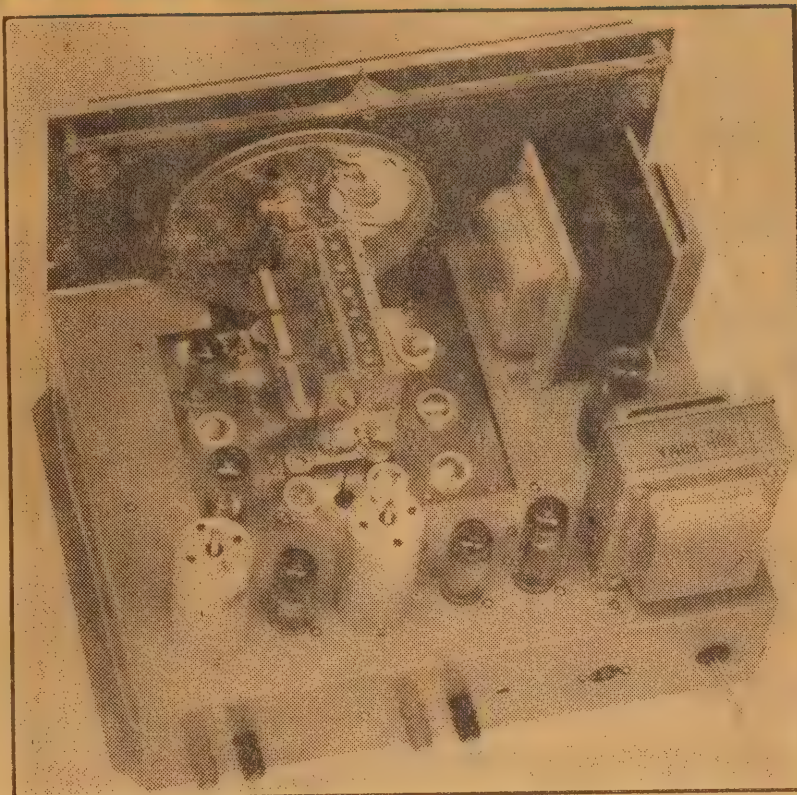
The shorter plate lead also means less chance of instability, one side of the voice coil circuit can be earthed conveniently and an extension speaker can be fed from it without having to worry about high voltages. They're all small points but important enough to justify mounting the output transformer where we did.

The circuitry is straightforward and does not call for any involved explanations.

As we explained earlier, the tuning unit is completely wired and needs only the connection of a few external leads to ensure its operation.

The "IF" plate, "B-plus" and "AVC" connections are quite obvious, as also are the earth bonds to the main chassis.

Only one heater lead is brought out, the other side of the heaters being earthed to the frame of the tuning unit. This means, of course, that one side of the relevant 6.3 volt winding has likewise to be earthed,



Looking on the rear of the chassis. Note how the tuning unit carrying the RF and converter valves protrudes through a large cutout in the centre of the chassis. IFT1 is at the left, then the 6N8, IFT2, the 6BD7 and the 6M5. The 5Y3-GT is between the filter choke and power transformer.

the other side being connected to the active lead from the unit.

Some kind of a divider system is necessary to supply the screens of the RF and converter valves. For the sake of simplicity, we have specified a network of three .05 meg 1-watt resistors. (47,000 ohm resistors would do equally well).

This applies something less than 100 volts to the screens with no AVC applied, the voltage rising somewhat as stations are tuned in.

Since the valves in the unit are already provided with cathode bias, the AVC line must work initially from earth potential. This rules out the back-bias system, which we used in last month's Four-Band receiver.

The AVC is picked up from the 6N8 diodes, fed from the plate circuit of the same valve. Since the valve operates with cathode bias — to match the arrangement in the tuning unit — and since the diode circuit returns to earth, the system acquires the necessary delay voltage.

The screen of the 6N8 is fed through a series resistor of such a value that the screen voltage is normal with no AVC applied. It rises steeply with the application of AVC but this is of no special consequence with three controlled stages. In any case, the 6N8 is better able to handle high level signals without distortion.

If you have any strong feelings on this point, it isn't very difficult to substitute a simple divider system in place of the series resistor.

For detection, we used the diode circuits of the 6BD7, mainly because the cathode of this valve is earthed. It allows the volume control, which forms the diode load, to return to earth and this is a handy point when switched over to pickup input.

The pickup switch, by the way, is provided by a spare set of contacts on the rear wafer of the wave-change switch. The appropriate shielded leads are looped up over the back of the unit and connected to the contacts, as indicated by the circuit. Similar contacts are available on the other banks to change dial lights, &c.

RF FILTER

The .0001 mfd capacitor and .05 meg resistor form part of the RF filter on the output of IFT2. There is enough shielded wire to do with the leads to and from the volume control to provide any additional bypassing effect that might be necessary.

For the rest, the audio system is quite conventional and needs little comment.

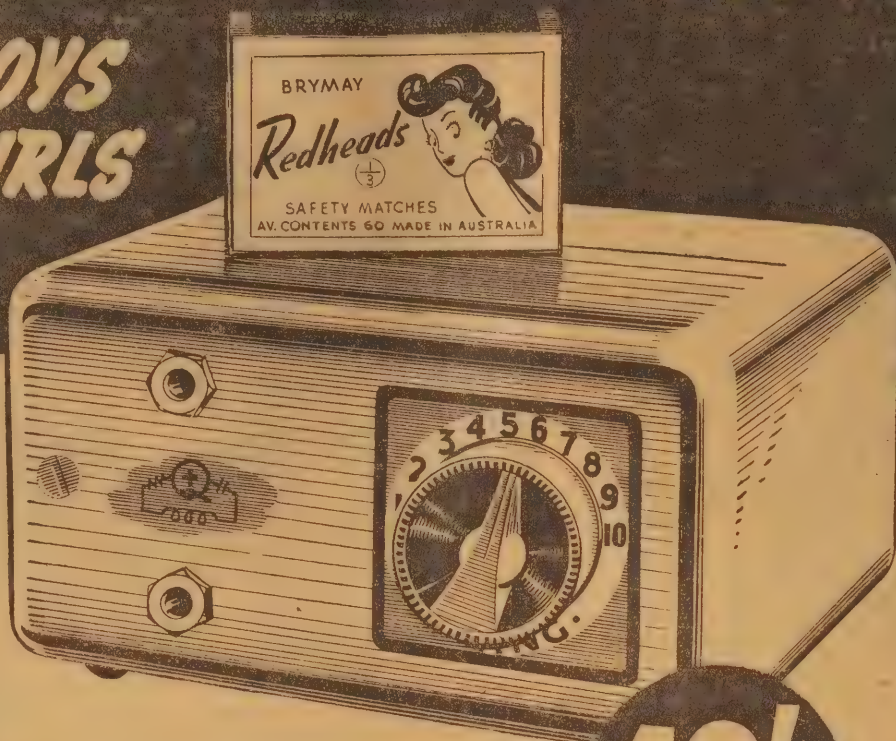
The same is true of the power supply, which is built around an 80-milliamp power transformer.

Depending on the details of this transformer and of the choke, the volts may possibly be a trifle high all round. If the HT looks like running above about 270 volts under typical conditions, it may be well to

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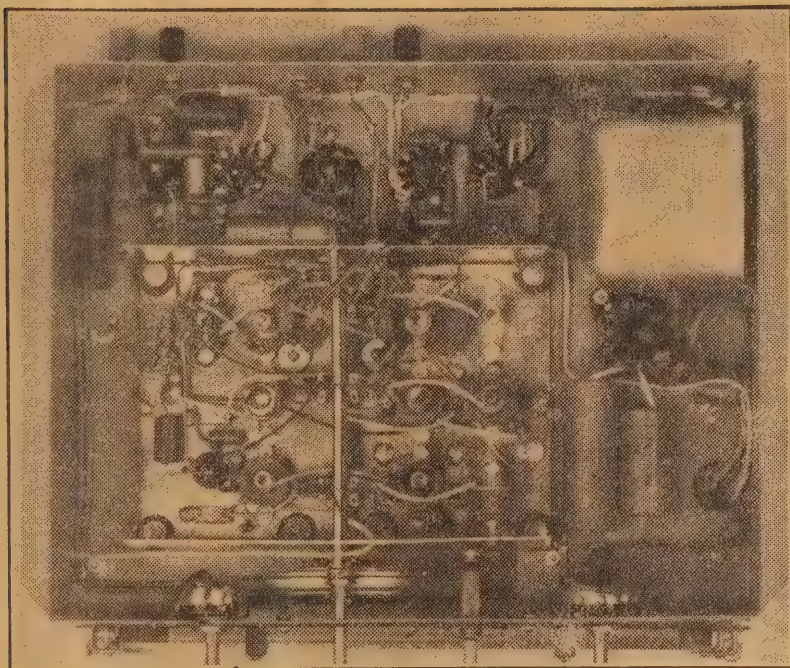
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UNDER-CHASSIS VIEW OF SET



There is just nize room for everything beneath the chassis, assuming the use of modern small wiring components. The wiring is best completed before they are mounted in position. The output transformer can either mount as shown or attach directly to the speaker.

connect a resistor of about 300 ohms, (10 watts) in series with the filter choke.

Originally, we wired into the set a 16 mfd 525PV electrolytic and a 16 mfd 350PV type, the latter on the filtered high tension line. This was in line with what we did in last month's receiver.

On second thoughts, and remembering that the 5Y3-GT rectifier comes up to operating temperature very quickly, we amended the circuit to show two 525PV types. In this case, it costs very little to play safe.

MAINS SWITCH

An item which you can regard as optional is the mains switch on the rear of the tone control potentiometer. If you do use it, it may be wise to provide for an extra position on the tag strip near the rectifier. So much for the circuit.

Coming to the construction, the first job is to make sure that the dial and tuning unit will fit properly into place. It's much easier to drill extra holes or enlarge cutouts on a bare chassis than one which is completely wired!

You should be able to pass the wave change spindle through the hole in the chassis and, by angling the unit slightly, pass the gang capacitor up through the cutout, so that the unit slips into place. It should bolt into position with the front plate of the unit about 1 3/8 in behind the front edge of the chassis.

With the tuning unit bolted temporarily in place, the next thing is to fit the dial.

It becomes immediately obvious that there is no room for the flywheel, at least not without mount-

ing the whole dial well forward and extending the shafts — including that of the tuning gang.

We suggest therefore, that you accept the inevitable and do without the flywheel, providing other means to keep the shaft in position. Loosen the grub screw and slip the flywheel off the shaft.

Now slip a quarter-inch washer over the shaft and push it lightly against the bearing bracket. Drill a very small hole behind the washer, through which you can pass a loop of wire or, better still, a small cotter pin. This washer and pin will prevent the spindle moving forward out of position.

The excess spindle can now be cut off, which should allow the dial plate to mount flush against the face of the chassis.

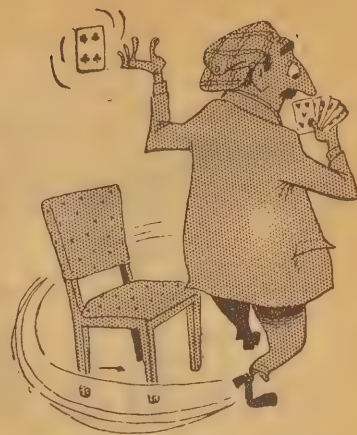
Since the drum has to be moved to one side to attach to the gang spindle, it will be necessary to reduce the tension on the driving cord, allowing the springs to relax almost completely.

DIAL MOUNTING

Now grip the drum and dial with one hand while you remove the screw holding the two together. Shake the spacing washers out, then slip the dial into place on the chassis, working the drum to one side and onto the gang spindle at the same time. With a bit of care and luck, you won't drop and tangle the cord.

See that the cord is free, bolt the dial in place, lock the drum to the shaft and make sure that everything is working smoothly.

This done, take the dial off again, replace the screw holding the drum and put it aside. Mark the outline



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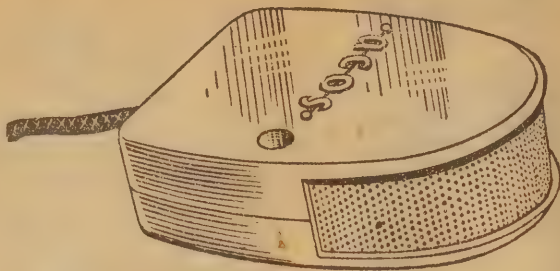
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2000	2	3-4	5	8600	8350	4300	3620	2150	1070	—	—	—	—	200	—
2000	1	2-5	8	15700	11400	7900	6850	3920	1950	—	—	—	—	350	—
3000	2	3-4	5	15000	8400	6500	3500	3240	1620	—	—	—	—	300	—
3000	1	2-5	8	23500	17000	11800	10000	5900	2850	—	—	—	—	520	—
3800	2	3-4	5	18400	12600	8200	7000	4100	2050	—	—	—	—	380	—
3800	1	2-5	8	28800	21500	15000	12800	7500	3740	—	—	—	—	680	—
4000	2	3-4	5	17400	12500	8650	7300	4300	2180	—	—	—	—	400	—
4000	8	9-10	11	—	—	—	—	—	—	—	—	—	—	—	—
5000	2	3-4	5	21600	15700	10800	9150	5400	2700	5500	3450	2380	1850	1380	500
5000	8	9-10	11	—	—	—	—	—	—	7000	4300	3500	2300	1730	300
6000	1	2-5	8	8600	6380	4300	3620	2140	1070	—	—	—	—	200	—
6000	8	9-10	11	—	—	—	—	—	—	8300	5180	4250	2750	2180	370
6800	1	3-4	6	9500	7000	4750	4000	2350	1180	9100	5650	4660	3000	2400	230
6800	8	9-10	11	—	—	—	—	—	—	9700	6000	5000	3200	2400	438
7000	1	3-4	6	10000	7300	5050	4280	2500	1250	11000	6900	5650	3700	2700	270
7000	8	9-10	11	—	—	—	—	—	—	9700	6000	5000	3200	2400	438
8000	1	2-4	6	12000	8400	5800	4900	2900	1440	11000	6900	5650	3700	2700	500
8000	8	9-10	11	—	—	—	—	—	—	12500	7750	6300	4150	3100	300
8000	1	3-4	6	13000	8400	6500	5500	3200	1620	—	—	—	—	—	350
8000	8	9-10	11	—	—	—	—	—	—	12500	7750	6300	4150	3100	350
8000	7	9-10	12	—	—	—	—	—	—	8200	5000	3200	2050	1550	370
10000	1	3-4	6	14400	10500	7200	6100	3600	1800	14000	8800	7100	4600	3450	390
10000	8	9-10	11	—	—	—	—	—	—	6900	4300	3500	2300	1740	600
10000	7	9-10	12	—	—	—	—	—	—	8200	5000	3200	2050	1550	370
12000	1	3-4	6	17400	13000	8700	7250	4320	2160	8300	5150	4250	2750	2070	400
12000	7	9-10	12	—	—	—	—	—	—	8700	5000	4000	3200	2440	430
14000	7	9-10	12	—	—	—	—	—	—	11000	6900	5600	3700	2780	500
16000	7	9-10	12	—	—	—	—	—	—	12500	7750	6300	4150	3140	550

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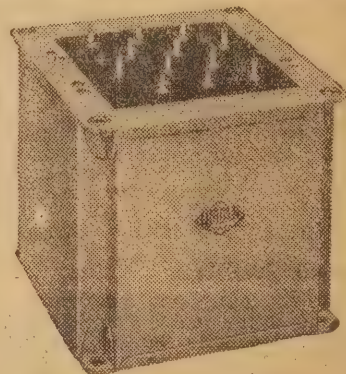
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Watts
30
60
120

R.F. Imp.
Watts
60
120
240

Max Sec.
Current
120 Ma.
200 Ma.
250 Ma.

Overall Size

L. W. H.
3 3/4" x 3 1/2" x 3 3/4"
5 1/2" x 4 1/2" x 5 1/2"
5 1/2" x 5 1/2" x 5 1/2"

Weight
lbs. ozs.
5 8
11 8
14 8

of the tuning unit under the chassis, then remove the tuning unit also. You will find it much easier to wire the rest of the chassis with it right out of the way.

Next job is to mount the sockets. The keyway of the 5Y3-GT socket faces the power transformer, while the blank section of the 6M5 socket (between pins 1 and 9) faces inward toward the centre of the chassis.

The 6N8 socket is mounted with the blank space facing in the same direction but the 6BD7 goes round the other way, with the blank space toward the rear.

Mounting the sockets in this fashion ensures short grid and plate leads.

SOLDER LUGS

We suggest that you put a solder lug under each of the inner mounting nuts. To facilitate the wiring later, a tag strip can also be supported toward the front nut of the rectifier socket.

Next mount the power transformer and choke, passing the leads down through the grommetted holes to the underside of the chassis. Slip a solder lug, facing inward, under each of the transformer bolts.

In mounting the IF transformers, see that the plate pins face toward the front of the chassis, the grid pins toward the rear.

Mount the speaker socket and the terminals, slip the potentiometers into position and you are ready to turn your attention to the wiring.

Begin by wiring the heater and plate pins of the rectifier, then earth the HT centre tap and the internal shield of the transformer. Leave one 6.3V winding untouched but extend the other one so that it can be run around to the 6M5 socket and from there to the remaining two valves.

Earth one side of this heater string, say at the 6M5 socket.

While you are at it, run a length of tinned copper wire between the various solder lugs and also earth the centre spigots and any other valve sockets lugs that are indicated on the circuit.

We suggest now that you connect up the power cord, using a couple of INSULATED positions on the tag strip to join the power cord to the transformer primary leads.

It should now be possible to plug the set into the power temporarily

and, by inserting the valves, observe that the heaters light up. Keep your fingers away from the rectifier socket, however.

Disconnect the set from the power and proceed now to wire up the high tension power supply. The main filter capacitors mount, as shown, below the power transformer, the negative ends being earthed to a busbar and the positive ends to lugs on the tag strip mentioned earlier.

Wire the 6M5 socket next, including the plate, screen, cathode and grid circuits. You will find it convenient to mount an 8-tag strip in front of the 6M5 and 6BD7 sockets and just clear of the space to be occupied by the tuning unit.

The 6M5 grid stopper (.05 meg.) can mount between the grid pin and an insulated lug on the tag strip, passing thence via a shielded lead to the tone control potentiometer.

If you now wire up the speaker socket, installing the output transformer in position, the rectifier, the output valve and speaker can be plugged in and this much of the set checked for normal operation.

The voltage will be high, of course, so don't leave it on for any length of time. You should be able to establish, however, that a clicking noise or a hum is audible when the 6M5 grid is touched with a screwdriver.

As the next step, we suggest that you wire the 6BD7 circuit using the remaining lugs on the tag strip to provide anchor points. We used the lugs in the following order, starting from the 6M5 end:

1. B-plus, return for 6M5 plate bypass, feed to 6BD7.
2. Earth.
3. Anchor for 6M5 grid stopper, coupling capacitor.
4. 6M5 plate connection to .75 feed-back resistor.
5. 6BD7 plate decouple point.
6. 6BD7 grid coupler.
7. Earth.
8. Diode load anchor point.

SHIELDED WIRE

The wiring to volume control, diode filter and pickup terminals must all be run in shielded cable and arranged so that it will pass up over the rear of the tuning box to the switch section, as already mentioned.

If you like, the 6BD7 can now be installed and this much of the set checked for operation. Touching the grid circuit of the 6BD7 should produce a healthy hum or squeal in the speaker, indicating that the audio system is in order.

Now comes the task of mounting the dial and tuning unit — and this is where the initial effort of fitting it pays off. It should slip into place and it's only a few minutes' work to connect up the various leads.

We took the precaution of running the aerial lead out through a hole, along the outside of the chassis and back inside again just near the aerial terminal.

Plug in the 6BA6 and the 6AE8. If the wiring is okay, as indicated by your previous "progressive" checks it should be just a matter of switching on and tuning your first station. That's the way it was with us.

Identify a station near the centre of the band, slacken the dial locking screw and re-tighten it with the dial pointer indicating that station. Check the dial accuracy at the ends of the band and make any slight compromise adjustment that might be necessary to get the best average accuracy of calibration.

Now tune in a weak station — or a stronger one without an aerial connected — and touch up the IF transformer cores for maximum response.

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36	.0076	x	x	x	x
33	.0071	x	x	x	x
37	.0068	x	x	x	x
34	.0063	x	x	x	x
38	.0060	x	x	x	x
35	.0056	x	x	x	x
39	.0052	x	x	x	x
36	.00500	x	x	x	x
40	.0048	x	x	x	x
37	.00445	x	x	x	x
41	.0044	x	x	x	x
42	.0040	x	x	x	x
38	.00397	x	x	x	x
43	.0036	x		x	x
39	.00353	x		x	x
44	.0032	x		x	x
40	.00314	x		x	x
41	.00280	x		x	x
42	.00249	x		x	x
46	.0024	x		x	x
43	.00222	x		x	x
47	.0020	x		x	x
44	.00198	x		x	x
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PG9-53

FROM THE SERVICEMAN WHO TELLS

One of my stories this month concerns an old time mantel set, of unconventional design, and a fault which was unique in that it would not be possible in a conventional set. The second story is another case of a beginner who became hopelessly tangled up trying to repair his set.

THE veteran mantel set must surely rank among the first mantel models to appear on the Australian market and much of the interest centres around the unusual circuit design. They were very popular in their day and over the years I must have serviced dozens — or maybe hundreds — of the things.

But I can't say that this has fostered any great affection for them, for their unusual circuitry and compact layout makes the serviceman's job a difficult one, to say the least. Nor is mine an isolated opinion, most of my colleagues being prone to utter caustic comments whenever one is mentioned.

SPEED

(Maybe I'm being unduly biased from the serviceman's point of view, but I do think that the ability to service a set quickly and easily is something which warrants more attention than it is usually given. After all, the customer has to foot the bill for lengthy service work, and this must detract from the set's good name when he gets around to thinking about a new model.)

This set's main characteristics are an RF stage, a reflex IF-cum-audio stage, and, most unusual of all, a tuning condenser which is completely insulated from the chassis, the earthy side being returned to the AVC line. In fact, this floating section comprises not only the gang, but also the entire dial mechanism and volume control.

In spite of the number of these things which I have handled and the people I have questioned (some of whom SHOULD have known) I have never yet been given a convincing reason why the designers ever did this. Maybe they hoped to save the cost of a few AVC by-pass condensers, but it does seem to be doing things the hard way just to save one or, at the most, two such inexpensive items. Maybe they had a more logical reason but, if so, I have yet to hear of it.

WHISTLES

Anyway, to get back to the particular set in question. The owner complained that it whistled when being tuned and also suffered from intermittent changes in volume. This last effect could sometimes be brought on or cured by exerting pressure on either the volume or tuning control. At other times it would occur for no apparent reason.

When in one of its "loud" moods the volume control was unable to cope with the signal, there being quite a substantial level remaining even with the volume control turned right off. This was even worse than the normal minimum volume effect which is a characteristic of all reflex sets.

A check on the bench confirmed

the complaints. The set was hopelessly unstable and the volume could be made to vary by pressing on the control knobs. Strangely enough, this effect was very much less in evidence when I had removed the chassis from the cabinet and turned it up on the bench for inspection. I decided to concentrate on the instability first and worry about the intermittent effect later.

BYPASS SUSPECT

I suspected an open circuit by-pass of some kind as the most probable cause of the oscillation, but checking on this was not so easy. The sockets of the three vital valves, the RF amplifier, converter, and reflex amplifier, were barely accessible under a pair of IF cans mounted on the side of the chassis.

Eventually I rigged up a .5 mfd on the end of a test lead, using the other end to probe into the innards of the set's front end. But even so I was working blind, for it was almost impossible to see which pin was which. Nevertheless I kept prodding at each in turn until eventually on the 6B7 (reflex amplifier) socket the by-pass seemed to have some effect.

With the prod on one particular pin the oscillation ceased and a check back and forth across the dial failed to reveal any sign of it. Well, that was a lead anyway; it only remained now to identify the pin and then locate the faulty component associated with it.

But this wasn't so easy, either. The designers didn't believe in anything so simple as locating the various components alongside the appropriate pins. Dear me no; these would be found at the other end of the chassis tied up in a bundle like a bunch of firecrackers, with leads running out to various parts of the chassis.

LEAD TRACING

Identifying the socket pin was not really so difficult and it turned out to be the cathode. Then came the task of tracing the lead from it to the aforementioned bundle of components. Then I had to open the bundle to get at the actual component, and this involved taking the side out of the chassis, the bundle being held in place against it with a metal strap.

Eventually I reached the component I was seeking. It was a 25 mfd electrolytic, which was more or less expected, but I was not prepared for the brand on it. It was an American "Solar", a type which has not been seen in this country since well before the war.

It also explained why it was no longer functioning. After all, any electrolytic can be expected to dry out after 15 years. The situation was aggravated, of course, by the

need for this condenser to serve as a bypass for both intermediate and audio frequencies, since both would be present in the reflex amplifier.

I have never regarded this as good practice because, in general, electrolytics make poor high frequency by-passes.

There was another electrolytic in the same bundle. This was the cathode by-pass for the output stage and, although not quite as old as the other one, it was still a type which has not been made for many years. I decided to replace this also, since the cost of the component was small compared with the labor involved in getting this far.

EXTRA BYPASS

I also added a paper by-pass in parallel with the reflex amplifier electrolytic, for good measure.

With the new capacitors in place and the side of the chassis refitted, the set worked quite well, that is, until I turned it right way up. Then it immediately commenced its tricks of jumping up and down in volume as the controls were operated. It did not take me long to establish that the earthy side of the gang was intermittently shorting to the chassis, thus short-circuiting the AVC line.

When this happened the front end of the set was running at "full throttle" and a strong local station could put a very solid signal into the reflex amplifier. Since these devices are notorious for their minimum volume effect at any time, it is little wonder that it was really bad when the AVC failed.

But it was one thing to establish that the gang was shorting to chassis and quite another to find out where. At first I thought it would be easy but, probe as I might, I couldn't locate it. When the obscure nature of the trouble became evident I turned my attention to the actual method of mounting and insulating the gang.

GANG MOUNT

The gang was mounted below the chassis and supported by three pillars set in rubber grommets on the chassis. These were obviously of the same vintage as the electrolytics and were hard and crumbly.

As far as I could see they had probably become so compressed over the years that they were now allowing some part of the gang to approach too close to the chassis. In any case, it was fairly obvious that the rubbers would have to be replaced, and that, in order to do this, the gang would have to come right out.

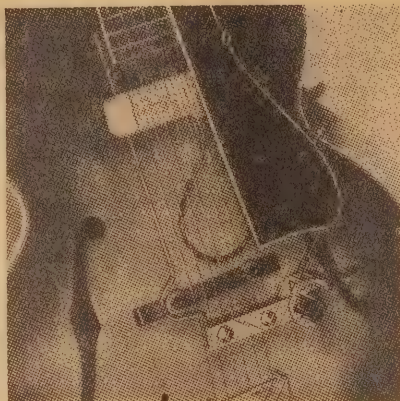
To gain access to the nuts on the gang pillars I had to remove the speaker from its bracket on the chassis. Then I had to remove the dial pointer, the dial scale, and part

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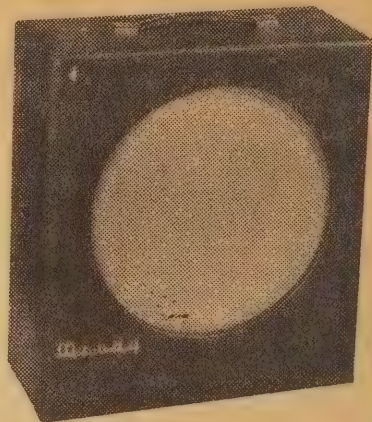
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of the dial mechanism in order to get at two screws which held the dial in place. Next I removed a metal strap from the front of the chassis and, finally, unsoldered about a dozen connections around the gang. Then, and only then, was I able to slip it out of the chassis.

With new gang mounting rubbers fitted, I put the gang back in place and checked for shorts between it and the chassis. This time all was well and I was unable to produce a short, even with extreme pressure on the controls. Then came the job of replacing all the parts I had removed. The speaker back on its bracket, the dial mechanism, the dial scale, the pointer, and several straps and screws.

AWKWARD JOB

Incidentally, as far as I know, there is no method of replacing the volume control in one of these sets without going through almost exactly the same procedure, particularly as one would almost certainly be forced to use a rather thicker type than the original. Fortunately the original controls appear to be of good design, because I have not yet struck a faulty one. Here's hoping I never do!

Finally the gang sections were resoldered, the set-up checked again for any sign of the short and, when it passed this test, I switched it on. I must admit that it proved itself capable of quite a good performance, but I'm afraid I will never be really sold on the reflex idea.

Certainly the sensitivity was high and it was possible to tune in several small country stations in daylight. Unfortunately the more powerful locals overloaded badly and produced serious minimum volume effects. The designers had foreseen this possibility and fitted a "local/distance" switch at the back of the set. Setting it to the "local" position enabled most of the locals to be received satisfactorily, but a couple of the weaker ones were not really at their best.

CONFUSING CONTROL

Thus, in order to receive all the local stations satisfactorily, it would be necessary for the user to juggle the switch at the back of the set according to the station desired. Knowing the average non-technical user, and his—or her—inability to handle even the barest minimum of controls intelligently, I am forced to class sets of this kind as unsuitable for unskilled operation.

Fortunately the owner of this particular set did know enough to understand the need to adjust the switch according to his station requirements.

But I rate him as the exception rather than the rule.

My next story is another case of a home constructor who attempted to repair his set and finished up in a hopeless tangle.

I first became acquainted with the set when he asked me about the possible cause of a gradual loss of sensitivity. I suggested that the first thing to do was to check the valves, and that he might care to bring them along to the shop. This he did and when a test showed them all to be in good condition, he naturally wanted to know what else to check.

At this stage I wanted to know

something of the type of set involved. The valve types gave me some idea but I wanted a more definite picture. It seemed that he had acquired the set from an amateur who, in turn, had built it, partly from standard circuits and partly from his own ideas.

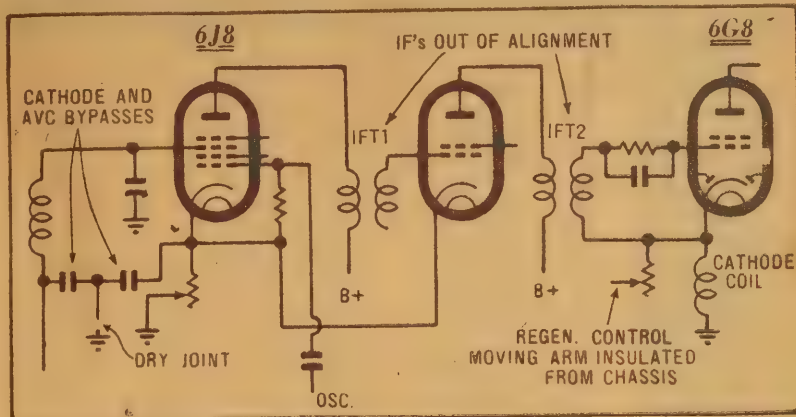
By careful questioning I slowly pieced together a rough description. Basically it appeared to be a standard five-valve dual-wave set to which had been added such refinements as regeneration in the IF stage, an RF gain control, and an AVC "ON/OFF" switch.

When these controls were added to the normal tuning, audio, and tone controls, the array was rather formidable. Nevertheless, the owner had apparently managed to master them sufficiently to get very good

ones? After all, the cost would not be very great and at least I would know that all these parts were OK."

I replied that there was no real objection to the idea except that it seemed to be doing things the hard way, while there was the very real possibility that none of these components was at fault. If such was the case much time and money would have been expended to no purpose.

Nevertheless, the owner seemed keen on the idea, so I suggested that he replace each component one at a time, checking the set after each replacement, so that he would at least have the satisfaction of being able to pinpoint the faulty component if there was one. Apparently this idea hadn't occurred to



A series of troubles caused poor performance in this circuit as related in the text.

results before the overall gain had commenced to fail.

Unfortunately there seemed to be little advice that I could give him. He did not possess a multi-meter and admitted that, in any case, the various readings would mean very little to him in terms of actual faults.

I did suggest that the alignment may have drifted, since I learned that the set was a fairly old one and used the old style IF transformers with trimmer adjustments. Alternatively, it was possible that faulty electrolytics had reduced the HT voltage, though it seemed hardly likely that this could affect the set as much as was indicated.

SCREEN CIRCUIT

More likely was the possibility that the screen circuit of the IF valve was at fault, since this would seriously impair performance.

All this, of course, was pure conjecture. Without being able to get my hands on the set I could only guess, and rather vaguely at that. I said as much to the owner and suggested that it might be best if he brought the set to the shop, particularly as he had no accurate method of checking even those possibilities that I had mentioned.

However, for various reasons, he was not keen to do this. For one thing the set was bulky and transport was a problem. For another—I suspect—he just didn't want to give it best.

His next suggestion was rather unusual: "Would there," he said, "be any objection to replacing all the resistors and condensers with new

him, but he did seem to think it a good one.

I heard no more about the set for some time. I had almost forgotten about it until the owner walked into my shop a few weeks later and poured out another tale of woe. It seemed that he had started on his project of changing parts but had apparently changed a whole group of them in one go. After this he was horrified to discover that the set was completely dead and no amount of tinkering with it would bring forth even a whisper of a station.

OWNER'S PROBLEM

What was he to do? Could I suggest a possible reason for the failure? I shook my head. There are faults which are so obvious that one can make a reasonable suggestion as to the possible cause and remedy, but this was clearly not one of them. Unless I could get the set on the bench it was useless for me to even try to help him.

Commenting that he had feared as much he left me with the idea of arranging transport and overcoming the other problems which had deterred him so far. As a result the chassis arrived at the shop a few days later and I set to to check it.

It was very much as he had described it, the most striking feature being the rather bewildering array of knobs along the front of the chassis. However, I soon identified these and set the thing up on the bench for a test. As the set warmed up the voltages settled down to normal figures and a finger on the audio grid cap brought forth a healthy "burp" from the speaker.

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U or F50/225	"	50	225/225	6.3v/2a			Upright or Flat	44/9
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U or F60/385	"	60	385/385	"			Upright or Flat	58/3
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U or F150/285	"	150	285/285	"			Upright or Flat	89/8
U or F150/325	"	150	325/325	"			Upright or Flat	96/7
U or F150/385	"	150	385/385	"			Upright or Flat	111/11
U175/425	"	175	425/425	6.3ct/3a	6.3/2a	5/3a	Upright	164/9
U200/385	"	200	385/385	6.3vct/3a	6.3/3a	5/3a	Upright	154/3
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This section seeming to be OK I turned my attention to the IF channel. Here things were not so good. The gain was very poor and it was soon obvious that the whole channel was very much out of alignment.

But worse was to come. As I brought the various windings into resonance the channel first became "soupy" and then finally spilled over into hopeless oscillation. This was a complication I had hardly bargained for, since the set had, presumably, been free from this defect in its original state.

REGENERATION

After making a quick check with an additional by-pass across the HT and screen circuits, without improvement, I decided it was time to make a more careful check of the circuit. Fortunately the owner had a rough copy, probably that from which the original owner had worked when he created the monster.

As I had already gathered, it was basically a five-valve dual-wave set, plus "refinements". One of these was the regenerative IF channel, obviously intended to squeeze the last microvolt of sensitivity out of the system. At the moment I was mainly interested in the method of achieving regeneration—and of controlling it, for the control provided for the purpose appeared to have no effect whatsoever.

As far as I could make out the system used a coil in the cathode circuit of the audio valve, which incidentally, appeared to operate as a leaky grid detector. Regeneration control was by means of a 5000 ohm pot, connected across this coil and which either shorted it completely out, when no regeneration was required, or increased the resistance across it to the full 5000 ohms if it was required that the stage oscillate.

The question now was: was the oscillation of the IF channel due to a failure of the regeneration control to really control things or was there some more subtle cause. An ohmmeter across the cathode coil gave a reading of about 10 ohms but there was no sign of any change in resistance as the pot. was rotated. A resistance check on the pot. showed it to be intact, so the problem resolved itself into finding out why its effect could not be observed across the coil.

NOT EARTHED

A few measurements with the ohmmeter soon revealed the secret. The pot. was a typical wire wound type in which the main shaft is connected to the moving arm, so that mounting the unit on a chassis automatically earths the moving arm unless precautions are taken to prevent this.

In this case it was vitally important that the moving arm be earthed in order to complete the control circuit. Unfortunately it was carefully insulated from the chassis by means of the insulating washers normally supplied with these components. Removal of the washers restored control of the regeneration system and the IF channel became perfectly stable except when the control was fully advanced.

And how did the pot. get like that? I later learned from the owner that this control had been inoperative for a long time. (This was due to the drifting off frequency and resultant loss of gain in the IF chan-

nel—only he didn't realise this.) Reasoning that, since it was the control which didn't work it must be the control which was at fault, he purchased a new control and fitted it in place of the old one, unfortunately omitting to discard the insulating washers.

Because the IF channel was in such a bad way the set was incapable of oscillating anyway, and so the changeover, though wrong, made no apparent difference. However, when I aligned the system it was a very different story.

But my troubles were by no means over. Although the IF channel now had normal sensitivity and was quite stable there was still no sign of any stations. It did not take long to establish that the converter was not oscillating, but the question was—why?

OSCILLATOR CHECKS

The valve had previously tested OK but substituting a known good one, just in case, made no difference. All operating voltages were correct, and the grid resistor was of correct value. I checked both padder and trimmers for possible shorts but found nothing, and I was beginning to wonder what to check next.

One thing I was not too happy about was the oscillator grid coil. Due to the physical layout of the set, with the dual wave deck mounted hard above the converter socket, it was difficult to check this. There was also the 50 pf oscillator coupling condenser which was tucked well under the bracket and could, conceivably, have gone open circuit.

In order to check both these points it would be necessary to remove the coil bracket. Little and all as I relished the prospect there seemed nothing else to do, so I set about removing such connections as would have to be freed before it could be lifted out.

One of these was the .1 mfd AVC by-pass, and this was earthed to the same solder lug as the .5 mfd converter cathode by-pass. In fact the two pigtails were clearly soldered together for some distance away from the lug.

DRY JOINT

As I freed the AVC by-pass from the bracket terminal and moved it to one side the two pigtails broke away from the chassis connection with only a minimum of pressure. Closer investigation revealed one of the best examples of a dry joint that I have seen for a long time. Apparently a small amount of solder had flowed around the wire and was holding it in place mechanically, but any hope of an electrical connection was ruled out by a liberal smear of greasy flux over the entire joint.

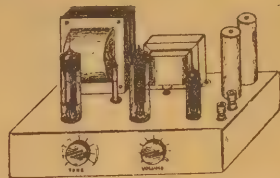
A general clean up and a hot soldering iron soon removed the unwanted resistance and, after restoring the other connections which I had removed, I switched the set on again. This time there was no mistake, all the local stations rolled in, along with a few of the more distant ones and the set looked like being quite a good performer. The only weak point was that the array of controls could easily confuse the non-technical user, though I knew that this would not worry my customer.

In fact he was more than pleased when he came to collect the set, claiming that it was now performing

(Continued on page 89)

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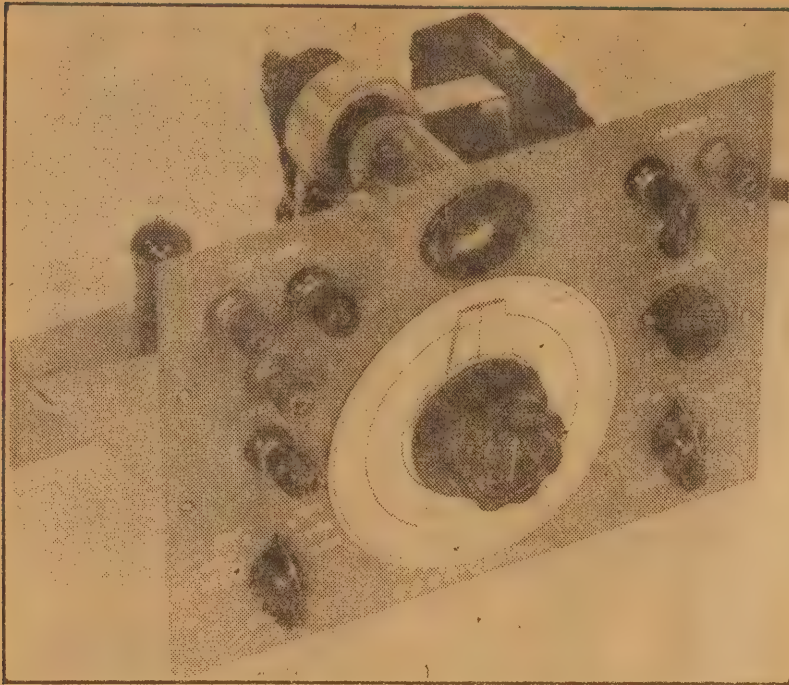
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This view clearly shows the new front panel layout with the scale ready for calibration. Note the convenient type of terminals. The tuning indicator is held in a rubber-lined aluminium bracket.

NEW DRESS FOR R/C BRIDGE

More than ever today, servicemen and home constructors require means for measuring values of resistance and capacitance. This unit does just that by comparing the unknown value with an accurate internal standard and showing the decimal relationship on the scale. Additional features include the indication of capacitor dielectric leakage and power factor, and the measurement of inductance against external standards.

AS far back as the December, 1948, issue, we described a similar R/C bridge which proved very popular by reason of its simplicity and versatility.

While this new instrument is fundamentally of the same design, it incorporates some worthwhile modifications. With the availability of more modern components, the layout, too, has been amended to produce a neater panel and underchassis arrangement.

The value of resistance measurable with this instrument ranges from 1 ohm to 50 megohms, with approximate values to 100 megohms, while that of capacitance ranges from 1 or 2 pf to 50 mfd, with approximate values to 100 mfd.

The need to approximate between "50" and "100" is simply due to the cramping of the scale markings around this region. However, the range of multiplying factors from .05 to 50 is quite adequate for normal requirements.

The unit carries two calibrated scales, one each for the resistance and capacitance measurements. There are three standards available in each

case, providing sufficient overlap to give complete coverage between the limits stated.

The appropriate standards are selected by the range switch. Also on this switch is a position which allows an external standard to be brought into circuit. This is intended for approximate inductance measurement as well as for checking the balance of one component value against another, without actually having to know the value of either.

This comparison can be made at 50 cps or at any other desired frequency, which may be available.

The "power factor", or "loss factor", control is automatically brought into circuit when the .01 mfd or 1 mfd ranges are selected. It permits

the bridge to be "balanced" when measuring "lossy" capacitors and, in so doing, gives the approximate power factor in percentage. We say "approximate" simply because there is no point in calibrating the control to a high degree of accuracy.

The leakage indicator is a neon lamp which flashes at each charge into a capacitor connected across the leakage terminals. The rate of flashing will depend upon the value of capacitor, but, with a little experience, the general condition of the capacitor dielectric can be assessed.

LEAKAGE

A continuous glow would obviously indicate that a capacitor has high leakage and should be treated with caution, if not discarded completely.

The bridge circuit employed in this design is the familiar Wheatstone type, which uses resistive ratio arms, with a standard in the third arm to be "balanced" against the unknown component in the fourth.

For the purpose of discussion, these four arms of the bridge can be considered as making up the four sides of a square, as shown in the basic sketch on page 47. The voltage source is fed across the outer ends of the ratio arm, while the indicating device is connected across the two remaining corners.

A condition of "balance" is obtained when there is no potential applied to the indicating device.

If the unknown happens to be equal to the standard, "balance" is achieved when the ratio arms are equal to each other because, in these circumstances, equal voltage drops occur around the two paths formed by the bridge and there will be no potential difference between the junctions feeding the indicating device.

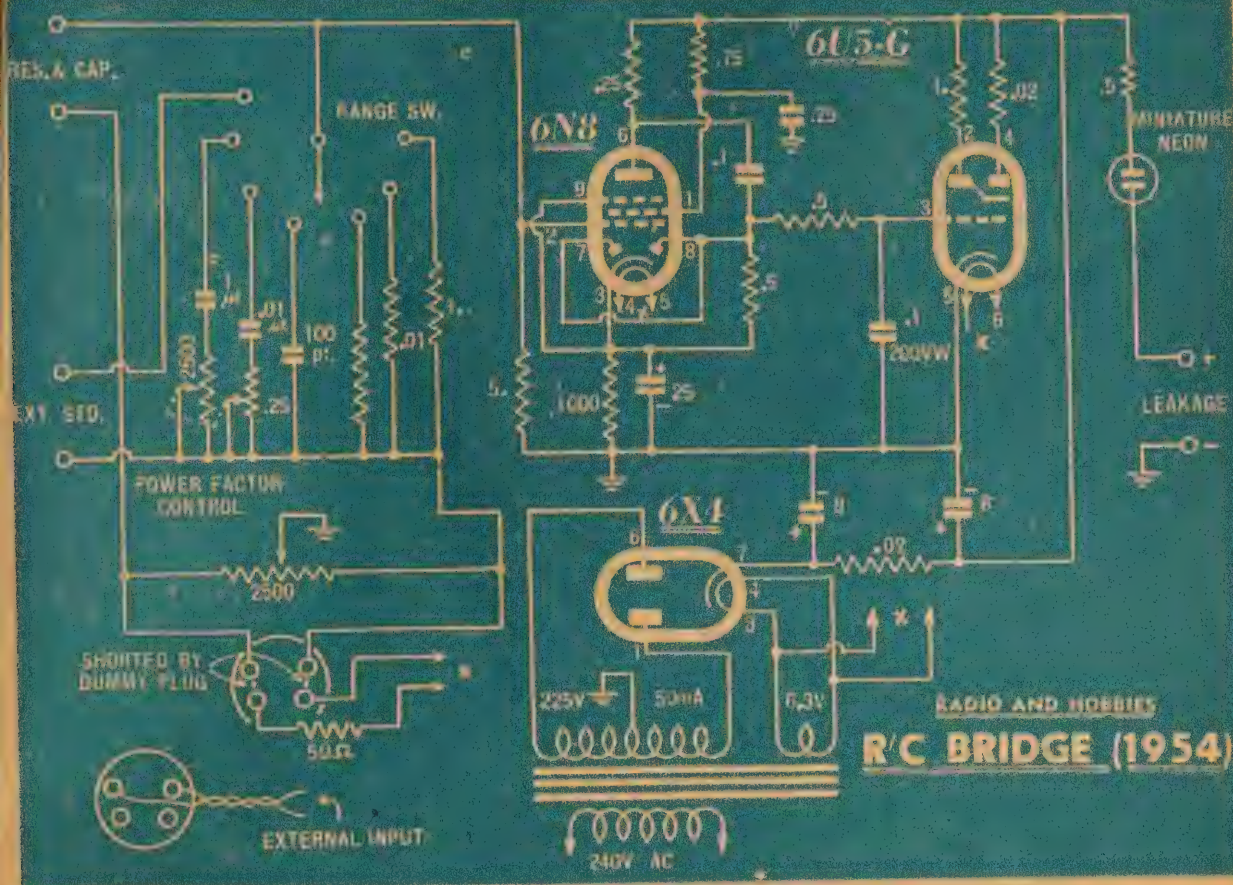
When the value of the unknown differs from that of the standard, the ratio arms will, at balance, take up the same ratio as exists between the standard and unknown and, as before, no potential difference will exist between the junctions feeding the indicator device.

In service instruments of this nature, it is usual to form the ratio arms by the resistance between the moving arm of a potentiometer and each end of the element.

As the bridge is fed with AC, a conventional audio voltage amplifier can be used to feed "out of balance" voltages to a visual tuning indicator, or "magic eye" as it is sometimes called. When the bridge is "balanced" the "eye" shadow is at a maximum.

by Raymond
Howe

CIRCUIT DIAGRAM OF NEW MODEL R/C BRIDGE



Here is the complete circuit of the instrument. Note the use of ganged potentiometers for power factor correction in series with two of the three capacitor standards. The tolerances for the standards are given in the parts list.

The sensitivity of the indicating portion has an important bearing on the sharpness of the "balance" or "null" indication. Too much sensitivity renders the ratio control too critical to adjust. We used a pentode amplifying stage to give what we consider as optimum sensitivity for conventional bridge use.

In the main circuit diagram, the wiring of the bridge and its voltage source is that portion to the left of the 6N8. It can be readily seen how the four arms of the bridge are made up with the 2500 ohm ratio potentiometer forming two of them and the unknown and a selected standard making up the other two.

EXTERNAL STANDARD

Note how the range switch can place an external standard in circuit through the particular terminals provided on the front panel.

The input to the 6N8 grid is taken from between the junction at the range switch arm and the earthed moving arm of the ratio potentiometer. A grid resistor is provided for this valve as there would otherwise be no grid return when the selector switch was set to a standard capacitor. This grid resistor is kept high in value to avoid undue shunting of the bridge arms.

The pentode section of the 6N8

is wired in the usual fashion with appropriate values of anode, screen and cathode resistors to give a nominal stage gain of about 150 times.

The output is fed back to the diode plates where it is rectified and appears as a negative voltage across the .5 megohm diode load resistor. As the signal frequency is

PARTS LIST

- 1 standard instrument case, 9 1/2 in x 6 1/2 in x 5 1/2 in with engraved front panel.
- 1 internal chassis 8 in x 5 1/2 in x 2 1/2 in with angle brackets.
- 1 power transformer 225V a side 50 mA, 6.3V 2A.
- 1 6N8, 1 6X4, 1 6U5G.
- 1 9-pin and 1 7-pin valve sockets.
- 1 4-pin miniature plug and socket.
- 1 6-pin chassis-mounting socket with cover.
- 1 1-pole, 12-position switch, 1 miniature neon lamp.

CAPACITORS

- 1 25 mfd 40PV and 2 8 mfd 525PV electrolytics, 1 .25 mfd, 1 .1 mfd, 1 .1 mfd, 200VW.
- Standards: 1 1 mfd 200VW 2 1/2 pc tol. (can type), 1 .01 mfd silver mica 2 1/2 pc tol., 1 100 pf NPO ceramic tubular 1 pc tol.

RESISTORS

- 1 5 meg. 1/2w, 1 1 meg. 1w, 1 .75 meg.

- 1w, 3 .5 meg. 1/2w, 1 .25 meg. 1w, 1 2-gang potentiometer of .25 meg. and 2,500 ohms (both linear), 2 .02 meg. 1/2w, 1 2,500 linear potentiometer.
- 1 1,000 ohm 1/2w, 1 50 ohm 1/2w.
- Standards: 1 1 meg., 1 .01 meg., and 1 100 ohm high stability 1 pc tol.

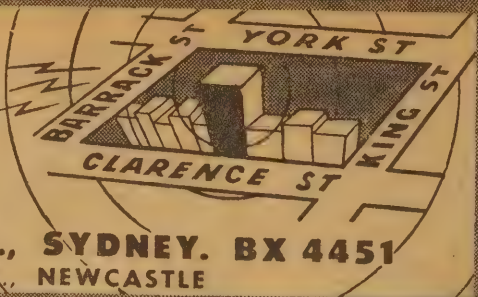
SUNDRIES

- 6 terminals (3 red, 3 black) insulated instrument type, 1 large instrument knob, 2 small pointer knobs, 1 "magic eye" escutcheon, 1 8-tag, 1 7-tag, 1 4-tag and 1 2-tag mounting strips, 3-core power flex and 3-pin plug, carrying handle and rubber feet for instrument case, scrap aluminium for tuning indicator bracket and clamp for 1 mfd standard capacitor, material for scale and cursor, 6 rubber grommets, tinned copper wire, hook-up wire, spaghetti, nuts, bolts, solder, solder lugs.

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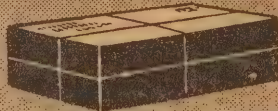
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at 50 cycles, we kept the coupling capacitor to the diode anodes up to .1 mfd and the screen resistor bypass up to .25 mfd to maintain the nominal gain at this frequency.

Obviously, the rectified output from the 6N8 will carry some 50 cycle ripple. This is filtered out by the .5 megohm and .1 mfd, before being fed to the triode grid of the tuning indicator.

Without this filter, the screen of the indicator shows a "double shadow" effect. Although this is not completely undesirable, we considered that the "single shadow" effect would be more acceptable.

TUNING EYE

In past issues of the magazine, we explained the operation of a tuning indicator. However, as a matter of interest, we can repeat it briefly.

Excitation of the fluorescent screen, called the target anode, is controlled by the potential on the ray control electrode, which is connected internally to the triode anode.

With no signal applied to the triode grid, such as when the bridge is balanced, anode current flowing in the triode portion causes a voltage drop across the triode anode resistor, making it negative with respect to the target anode. This means that the ray control electrode is also negative with respect to the target anode. In consequence, it repels electrons from the cathode away from portion of the target anode (or screen) leaving that portion in shadow.

The area in shadow is a function of the potential difference between the ray control electrode and the screen and has a maximum when the shadow angle is 90 degrees.

Conversely, when sufficient signal voltage is applied to the triode grid, it cuts off anode current in the triode portion and, consequently, the ray control electrode is at the same potential as the target anode. There is no repulsion of electrons from the target anode and all of the screen is illuminated, or, alternatively, the shadow angle has diminished to zero. Intermediate levels of signal voltage at the grid produce different shadow angles.

The 6U5-G seems to be readily available at the present time and for this reason we have used it in this circuit. This indicator requires minus 22 volts at the grid to close the "eye" for a supply voltage of 250. Some other types close with as low as minus 5 volts at the grid.

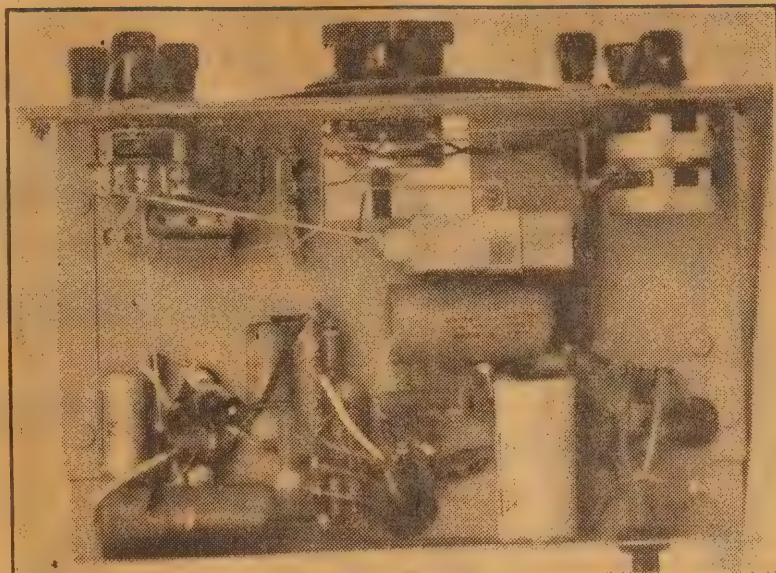
POWER SUPPLY

The power supply employs a standard 225 volt a side 50 mA power transformer feeding into a 6X4 miniature rectifier, the output from which is taken through a resistance-capacitance filter.

The comparatively low current drain on the supply does not demand a conventional filter choke. Furthermore, the selection of an appropriate value for the resistor allows the output voltage to be adjusted to just under the 250 volt mark without materially reducing the effectiveness of the filter.

You will note that the full output voltage is not fed direct to the target anode of the tuning indicator. A .02 megohm resistor is inserted to drop the target anode voltage to around 200 volts, the idea being that the life of the fluorescent screen of

UNDERCHASSIS VIEW OF BRIDGE



A clean layout is evident in this photograph with the bridge wiring towards the front of the chassis and the remainder towards the rear. The standards are grouped around the range switch with the 1 mfd capacitor held under a clamp between the two controls.

the indicator is increased without materially reducing the effective illumination.

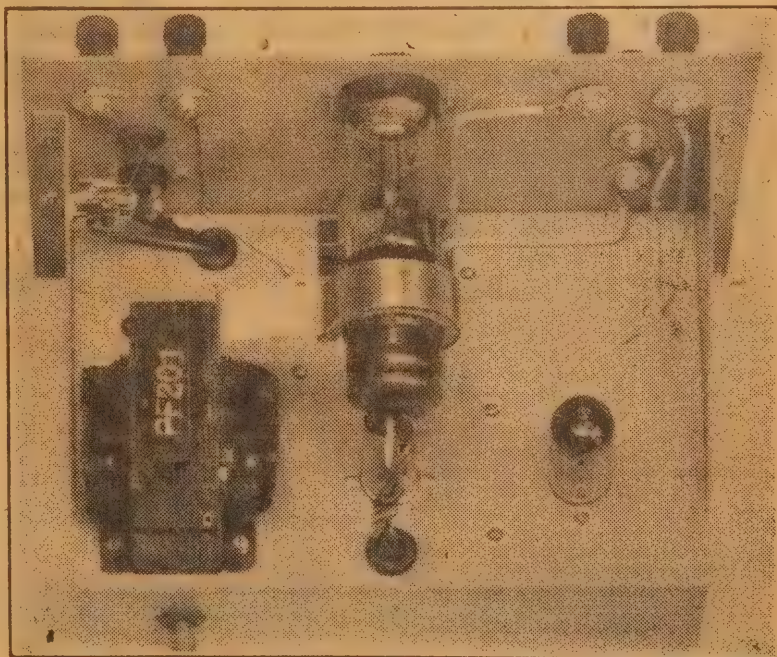
The leakage test on a capacitor dielectric is achieved by bridging the capacitor between high tension and chassis in series with a miniature neon lamp and a limiting resistor. Two terminals are provided for this purpose on the front panel.

When a capacitor is placed across these terminals, the neon will ignite on the initial charging cycle and will then extinguish. When the

charge on the capacitor leaks off as a result of its dielectric loss, the neon will strike again for the next charging cycle, and so on.

The frequency of the neon flashes is a function of the time constant of the capacitor value and the equivalent shunt resistance of the dielectric leakage. For a good quality .05 mfd or .1 mfd, the flashes may well be one minute apart.

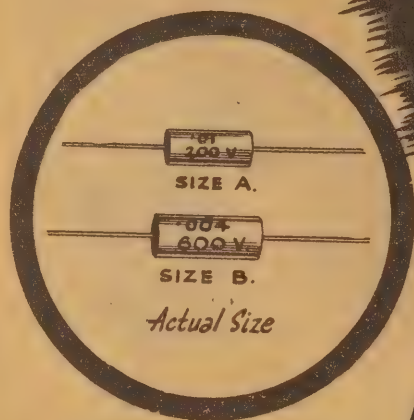
Smaller values will have shorter intervals between flashes. Capacitors having high dielectric loss will pro-



The 6N8 is at the right rear with the 6X4 in the centre under the 6U5G. The miniature neon and its series resistor is wired to the 3-tag mounting strip secured to the chassis bracket at the top left.

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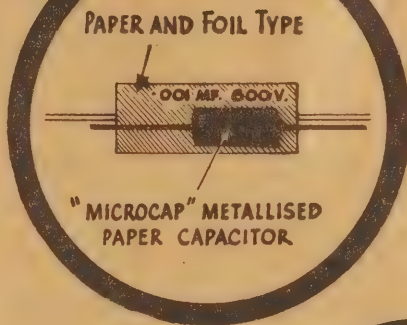
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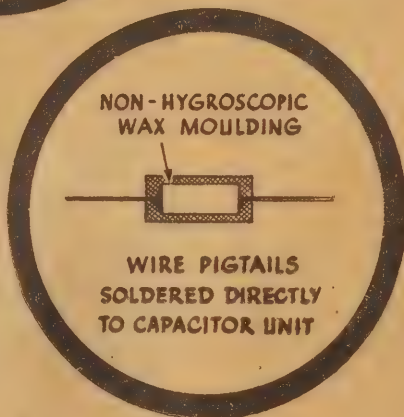
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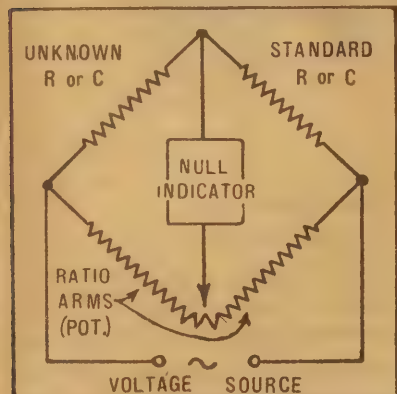
476 LATROBE STREET, MELBOURNE

duce flashes only seconds apart or will cause the neon to glow continuously. With a little experience, you will be able to assess the quality of a capacitor without having to wait for a second flash. You will find some relationship between the flash intervals and the power factor check.

Incidentally, an open-circuited capacitor will show no initial charging surge on the neon. Capacitors having a working voltage rating of less than about 200 volts should not be placed across the "leakage" terminals.

Getting back to the bridge circuit, you will note that the sole 6.3 volt heater winding supplies the bridge as well as the valve heaters.

A little thought will reveal that, with the range switched in the "100 ohm" position and a very low value



Basic circuit for the bridge network.

of resistance across the "unknown" terminals, a current of over 60 mA would pass through the standard resistor if the full 6.3 volts were applied to the bridge. This represents .4 of a watt dissipation in the standard resistor and it is desirable to limit this in the interest of stability.

More detrimental would be the condition where the matching and measuring terminals were used for the matching or measuring of inductors or other components having very low DC resistance.

It is for this reason that the 6.3 volt source to the bridge is fed through a 50 ohm limiting resistor. As the term implies, this resistor limits the maximum current which can pass through the 100 ohm standard resistor or external inductance standards of low DC resistance.

INDUCTANCE LIMIT

This will mean, of course, that there will be a lower limit to the value of inductance which can be measured because the lower the DC resistance of the standard and unknown values, the lower will be the voltage supplied to the bridge.

The resistance and capacitance standards set the basic accuracy of the bridge and it is desirable to obtain these to low percentage of tolerance. The tolerances available are as stated in the parts list and are of types which should maintain such tolerance over a lengthy period.

The hermetically-sealed can type for the 1 mfd range is recommended for both the low tolerance and the long-term stability features. Although we were able to obtain this

value to a tolerance of 2 1/2 pc, some suppliers may set 5 pc as the best they can provide. In most cases, this tolerance in checking tubular capacitors can be considered as being quite adequate.

The power factor control in this unit will give more accurate results over a wider range of capacitance than in the earlier bridge design. The availability of dual potentiometers permits two ranges to be covered on the same calibration scale, the value of each potentiometer being selected to have the same relationship as the two capacitance ranges involved.

The calibration of this control is made on the reasonable assumption that the standard capacitors have negligible loss factor. The control functions on the principle that the loss of a capacitor can be represented by a certain value of resistance in series with it and which can be "balanced" by a variable resistance in the standard arm of the bridge.

In practice, the main ratio control is set for the "null" condition on the "eye" and, if necessary, the power factor is adjusted to sharpen the "null" indication and to give the maximum (90 degrees) shadow angle on the "eye". In some cases, it may be necessary to readjust the ratio control.

POWER FACTOR

The power factor is calibrated on the basis that power factor, or loss factor, is the ratio of resistance to impedance. For a given value of resistance in series with the standard the loss factor of the unknown can be calculated by dividing this resistance value by the square root of the sum of the square of this resistance value and the square of the reactance of the standard capacitor. This result is multiplied by 100 to give an answer in percentage.

By stating this formula in symbols, it is a simple matter to transpose the equation by the usual algebraic methods to arrive at values of resistance for various percentages of power factor in steps of 10. The value of potentiometers used will accommodate power factors to 60 pc to take care of certain types of capacitors which are lossy though not unserviceable.

THE 1 mfd RANGE

Although this range is much greater than necessary, it permits the use of standard values of potentiometers.

For the 1 mfd range and a bridge excitation frequency of 50 cycles, the value of series resistance in the standard arm for a power factor of 10 pc would be just on 320 ohms, for 20 pc 655 ohms, 30 pc just on 1000 ohms, 40 pc 1380 ohms, 50 pc about 1825 ohms and for 60 pc 2370 ohms.

With the aid of a multimeter, the position of the control knob for the various power factor percentages can be marked on the panel. Although there may be certain errors in these calibrations which are unavoidable, it is to be remembered that extreme accuracy is not necessary. It does not matter a great deal whether a tubular capacitor, other than the dry electrolytic type, exhibits a power factor of 15 pc or 18 pc, for, in many applications, it will be unserviceable anyway.

Remember that electrolytic capacitors may show a high loss factor

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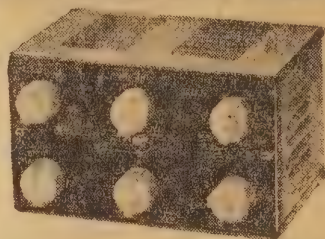
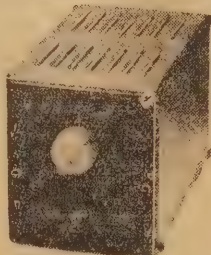
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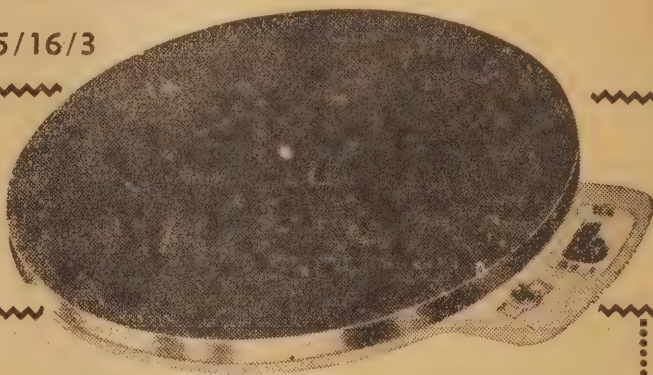
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reading if they have been out of service for some time, due to deterioration of the oxide film.

Manufacturers state that the film of these capacitors can normally be "reformed" by applying something approaching the rated voltage to the capacitor a number of times for two or three seconds at a time, allowing several minutes to elapse between each voltage application.

Another method is to apply 90 pc of the rated voltage to the capacitor in series with a .01 megohm resistor of several watts rating. After the voltage across the capacitor has risen to a stable value, it is ready for service.

CONSTRUCTIONAL

On the constructional side, there are a few points worthy of mention.

Before mounting any components on to the chassis, secure it to the front panel and fit to the case, drilling the holes in the front panel for securing to the case if these are not already present. You will note that the front bottom lip of the chassis should be slightly above the bottom lip of the front panel by the thickness so that the front panel will be correctly positioned in the case.

When fitting the terminals to the panel, see that all of them are well insulated therefrom. Admittedly one of the "leakage" test terminals will be earthed but it is advisable to connect direct to the chassis itself rather than rely upon the clamping action between the chassis and the panel.

The three controls should be packed behind the front panel and chassis so that the securing nut is just full of thread. This permits the knobs to be secured close to the panel to give a neater appearance.

Before finally securing the controls, measure and cut the shafts to the appropriate length. The ganged potentiometers should be positioned with the lugs toward the centre of the chassis, while the ratio potentiometer should have its lugs protruding through the cut-out in the chassis immediately below it.

VALVE SOCKETS

The next step is to mount the power transformer and valve sockets, bringing the leads from the power transformer through grommeted holes in the chassis. We orientated the valve sockets so that the gap between pins 1 and 7 of the 6X4 socket is toward the front panel while the gap between pins 1 and 9 of the 6N8 socket is toward the rear face of the chassis.

For providing junction points for the wiring and mounting for some of the minor components, we used a 7-tag mounting strip under the inside securing bolt of the power transformer, an 8-tag strip between the two valve sockets, a 4-tag strip between the range switch and the ratio potentiometer and a 3-tag strip on a side bracket just below the level of the neon leakage indicator.

The bridge wiring was made in 18-gauge tinned copper wire for the sake of rigidity and low wiring capacitances. The underchassis portion of this particular wiring was left bare while that above the chassis was covered in spaghetti sleeving.

The 1 mfd can type capacitor standard had to be mounted on its side and, consequently, the clamps usually supplied with this type are not usable. It is a simple matter,

however, to bend up a aluminium clamp to hold it in place.

The 4-tag mounting strip near the range switch is used to hold the remaining resistance and capacitance standards. Take care when soldering these standards into circuit to avoid the application of excessive heat to them. This can be minimised by grasping the remaining portion of the pigtail connection with a pair of long-nosed pliers which helps to conduct away the heat. In addition to this, try to make the soldered joint as quickly as possible but not at the expense of a poor connection.

The general layout of the remaining minor components can be deduced from the underchassis photograph. The sequence of connections from the chassis rear along the 8-tag mounting strip between the two valve sockets are, high tension, earth, indicator target anode, indicator triode anode, blank, indicator triode grid, earth, junction of two .5 megohm resistors, the .1 mfd capacitor and the diode anodes.

The 7-tag strip near the power transformer carries the high tension output from the filter, the 50 ohm resistor in series with the 6.3 volt source to the bridge and also the junction of the power flex and the primary of the power transformer.

It is important that 3-core power flex be used and the green-colored

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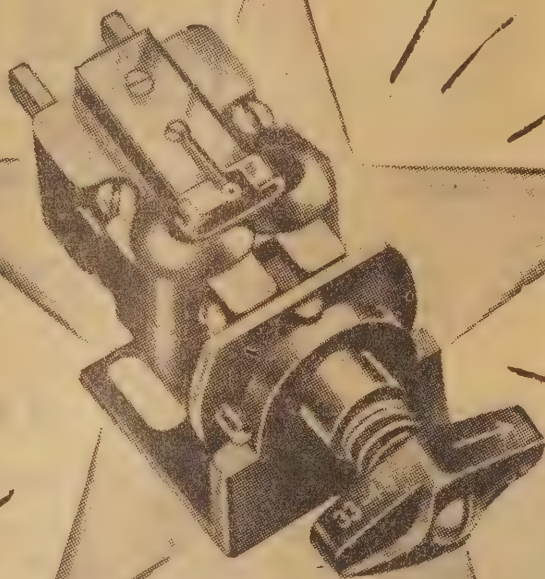
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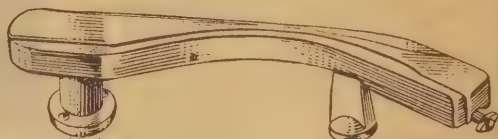
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Pick-up No. 500 -- £7/10/-
Cartridge No. 500 -- £5/5/-

Look at these unequalled characteristics:

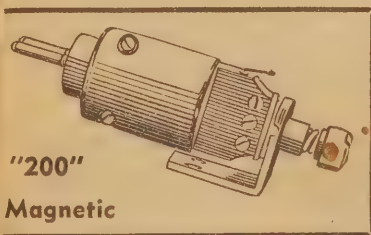
- Frequency response of from 20 to 20,000 cps. on standard, and 15,000 on L.P.
- Push-pull coil assembly cancels hum from stray magnetic fields.
- Added shielding which virtually eliminates all hum pick-up.
- Excellent tracking and prolonged record life. Even percussion recordings of highest recording level will track on 5 grams stylus pressure.
- Uniformity . . . to ensure consistency in tracking capabilities, cartridges are given a compliance test to a minimum limit of 3.0 x 10.6 cm-dyne.
- Safety stylus—stylus tip automatically retracts under excess pressure saving both the record and the stylus.



WITH BALL BEARINGS
AND HEIGHT ADJUSTMENT

No.
2

FULLY TROPICALISED, HIGH OUTPUT MAGNETIC TURNOVER PICK-UP No. 200



"200"
Magnetic

● SPECIFICATIONS:—

Output Voltage: 500mV at 3.16 cm/sec RMS.
D.C. Resistance: 7000.
Stylus Pressure: 14 grs. Std. and L.P.
Stylus Dimensions: Std. 0.00275in Rad. Sapphire L.P.
0.001 inches Rad. Sapphire.
Impedance: 40,000 at 1000 cycles.
Optimum Load: 100,000.

The Magna Cartridge No. 200 has been specially designed for use under tropical conditions of heat and humidity and can be most highly recommended for all territories where experience has shown crystal cartridges to be unsuitable.

★
Frequency
range
40-6000



● Ask for complete Goldring Cartridge, Stylus and Pick-up Catalogue. There's a Goldring Quality Product for every requirement. . . Goldring specialise in sound reproduction.

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core used to earth the instrument chassis back to the power mains earth system via the power mains wall socket.

The "leakage" test neon indicator is held in the front panel with a rubber grommet of appropriate size. Be careful when bending the pig-tail leads of the neon to make the soldered connections to the 3-tag mounting strip as it is easy to fracture the glass pinch at the base of the neon.

So much for the construction. Now for the calibration of the instrument.

From the discussion earlier in this article on the operation of the bridge, it is obvious that the ratio between the standard and an unknown resistance value is duplicated by the resistance between each side and the moving contact of the ratio potentiometer. That is, of course, when the bridge is brought into "balance" with the "eye" fully open.

To simplify calibration the three

resistance standards have been selected to be in decimal relationship. Thus, an unknown resistance value is obtained by multiplying the value of the standard resistance to which the range switch is set by the reading on the ratio dial scale at which "balance" is obtained.

Calibration simply involves placing known values of resistance across the "Res & Cap" terminals on the front panel and marking their ratio with the standard on the scale card under the knob pointer when the bridge is brought into "balance". Because of the range relationship, calibration points obtained with any one resistance range will apply equally well to the others.

CAPACITANCE VALUES

Because the bridge is supplied from an AC source, capacitance values are measured by reading the ratio of their reactance with that of the standard. As capacitive reactance is inversely proportional to the value of capacitance, the capacitance scale on the ratio dial will normally be in reverse direction to the resistance scale.

In point of fact, the capacitance scale should bear a reciprocal relationship to the resistance scale and it is possible simply to draw it in on completion of the resistance scale. This is a handy point because it might be difficult to locate capacitors of sufficient tolerance for actual calibration.

The alternative approach would be to replace the range switch with a 2-section type of the same pole and position combination and wire it in such a way that the arms of the

bridge carrying the standard component and unknown terminals change over when going from resistance to capacitance measurement. In this way the one calibration scale will serve the two purposes.

That concludes our general description of the bridge and the constructional details of how to build it. The calibration procedures we would like to deal with in full, and will therefore hold them over for next month's issue. They will appear in an article together with some further suggestions we have concerning this useful piece of test gear.

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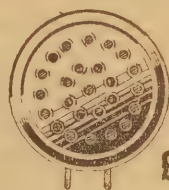
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- High output level — 50db.



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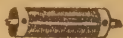
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Standard shunts to suit 100 ohm internal resistance meters. Price at 4/6 ea.



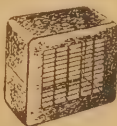
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All crystals are chemically etched to ensure that the frequency once set is permanent. Tested to an accuracy of 0.01pc over temperature range of 0deg to plus 60deg centigrade. Both amateur and commercial frequencies catered for. Write direct to us for quote.



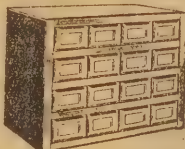
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This attractively designed Bin speaker box in an extremely modern design and will blend in with all rooms. Black wrinkled finish.

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WORTH NOTING

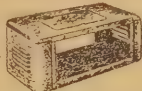
Tinned copper wire, 5/6 coil.
Screws - nuts - washers - solder lugs (all in separate packets) 2/6 pkt.
Rivets: Midget hollow, 3/- pkt.
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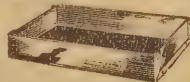
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15 1/4 x 7 x 8 1/2 deep. Suits chassis 11 x 8. Price 59/6, add postage.



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6 x 4 x 2	5/10
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13 x 10 x 2 1/2	14/-
17 x 8 x 3	17/6
17 x 10 x 3	19/3

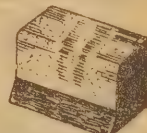
Please add postage



ALUMINIUM PANELS

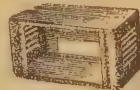
18G. .048in Thick

7 x 5 2/3	12 x 8	4/6
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Our standard model with louvred sides, radius corners, loose front panel. Black wrinkle finish. Size 11 x 7 x 5 1/2 deep. Panel 9 x 7. Suits chassis 8 x 5. OUR PRICE 26/9. Postage 5/- extra.



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Solidly constructed, 20G metal, complete with front panel. Black wrinkle finish. "A", 5 x 5 x 4 deep 15/-; "B", 7 x 6 x 4 1/2 deep 15/-; "C", 9 x 7 x 5 1/4 deep 17/-; Add postage

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THE NEW ACOUSTICAL QUAD

The new Acoustical Quad II is truly an instrument designed for the home. Its beautiful styling is unparalleled in the high-fidelity industry. Its specifications are second to none and were deliberately

obtained with up to 20 pc valve mismatch, to be certain that the Quad II will always exceed its published specifications. It is the most distinguished audio achievement of recent years combining Highest Engineering Standards with a New Concept of Styling for the home.

FEATURES:

Effortless finger-tip control—full range fidelity 10 to 60,000 cps + or - $\frac{1}{2}$ db—push button record equalisation—perfect plug-in matching to any pick-up—built in pre-amp—automatic circuit correction—-independent filter and filter slope controls—15 watts output throughout 20 to 20,000 cps—less than 0.1% total distortion.

Sole Australian Agents: BRITISH MERCHANDISING PTY. LTD., 183 Pitt Street, Sydney.

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MAGNETIC TAPE RECORDERS

The new Model 2A is presented in a physical form worthy of its technical excellence. Basically the same robust, time proven and reliable instrument it incorporates many refinements and facilities requested by discriminating Ferrograph owners and users. Attention to detail in the design and manufacture of every component part has ensured that a high standard is achieved throughout the complete instrument.

SPECIFICATIONS

Response + or - 3 db 50-10,000 cps at 7 $\frac{1}{2}$ in per sec. Synchronous Capstan motor. Simplified speed change. Provision for 1,750ft reels, i.e. 45 minutes per track at 7 $\frac{1}{2}$ in per second and 1 $\frac{1}{2}$ hours per track at 3 $\frac{3}{4}$ in. Twin track, fading facility, weight 49 $\frac{3}{4}$ lb.

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U.R.D. FOR HI-FI

TRUESOUND REPRODUCTION



GOODMANS

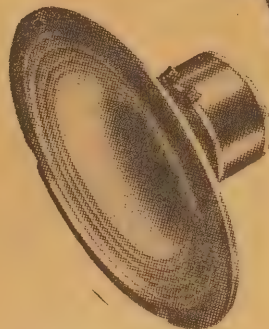
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AXIETTE 101

An 8-inch reasonably priced and medium sized single-cone loudspeaker with the requirements for the high-fidelity enthusiast. When suitably housed it will occupy the minimum of space and yet faithfully reproduce excellent tone. Like all specialised apparatus the AXIETTE 101 benefits enormously from the use of correct auxiliary equipment.

SPECIFICATIONS

Frequency Range, 40-15,000 c/s.
Fundamental Resonance, 65 c/s (nominal)
Flux Density, 13,500 gauss.
Total Flux, 51,200 maxwells.
Maximum Power Handling, 5 watts peak A.C.
Overall Diameter, 8 1/8 in.
Overall Depth, 3 5/16 in.
Net weight, 3 1/2 lb.
Fully Dustproof.



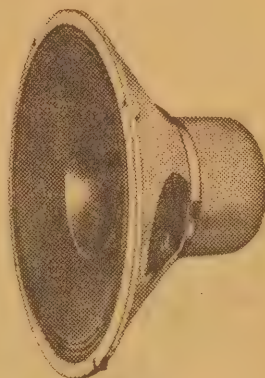
AXIETTE 101

AXIOM 150 MK. II

A 12-inch twin-cone full range high fidelity reproducer, with a power handling capacity of 15 watts. The combination of these features gives this precision built loudspeaker an extremely smooth coverage from 30 to 15,000 c.p.s.

SPECIFICATIONS

Frequency Coverage, 30/15,000 c.p.s.
Overall Diameter, 12 5/16 in.
Overall Depth, 6 15/16 in.
Fundamental Resonance, 35 c.p.s.
Maximum Power Capacity, 15 watts peak A.C.
Flux Density, 14,000 gauss.
Total Flux, 158,000 maxwells.
Nett Weight, 12lb 13oz.
FULLY DUSTPROOF.



AXIOM 150 Mk. II

AXIOM 22 MK. II

A 12-inch twin-cone high-power P.M. loudspeaker combining generous bass handling capacity with full range high-fidelity reproduction. The reproduction of first-class transmissions and of wide range disc recordings is remarkable for the incisive clarity and realism.

SPECIFICATIONS

Frequency Coverage, 30 to 15,000 c.p.s.
Overall Diameter, 12 5/16 in.
Overall Depth, 7 in.
Fundamental Resonance, 35 c.p.s.
Maximum Power Capacity, 20 watts peak A.C.
Flux Density, 17,500 gauss.
Total Flux, 195,000 maxwells.
Nett Weight, 18lb 4oz.
FULLY DUSTPROOF.



AXIOM 22 Mk. II

AXIOM 80

A medium-power FREE-SUSPENSION high fidelity P.M. reproducer for the professional enthusiast. The high efficiency of the Axiom 80 permits successful application and maximum listening pleasure without harmonic distortion when operated at a lower input.

SPECIFICATIONS

Overall Diameter, 9 1/2 in.
Overall Depth, 6 1/8 in.
Frequency Coverage, 20 to 20,000 c/s.
Fundamental Resonance, 20 c.p.s.
Maximum Power Capacity, 4/6 watts peak A.C.
Flux Density, 17,000 gauss nominal.
Total Flux, 62,600 maxwells.
Nett Weight, 9lb 6oz.
(Supplied with dust-bag)



AXIOM 80

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Here's your answer, Tom!

For some strange reason, Tom has a "bee in his bonnet" this month about color. Perhaps he plans to build one of those things that were talked about some years ago—the color organ.

HERE is Tom's first question, which prompted the above remarks:

Is there any relationship between color and sound? Are some sounds heard to better advantage in rooms of a special color?

Most definitely yes, Tom! To get the best effect from the morning serials, one should paint the living-room in tones of morbid, non-glossy black.

For Parliamentary broadcasts white walls would be better, illuminated with lights which could change their color, as required, from shades of green, through orange to deep red. Other colors might suggest themselves!

On a more serious plane, the relationship of color to sound has been argued for years and without

even built "color organs" in which the keyboard was arranged to control banks of colored lights, instead of acoustic pipes. They were disappointed if the audience could not "see" the tune as clearly as they claimed to do so themselves.

I guess an Hawaiian melody wouldn't be too bad but modern jive would look more like trouble with intermittent contacts!

COLOR RESPONSE

While it may be hard to prove any direct physical relationship between color and frequency, it may be possible to demonstrate some similarity in one's emotional response to distinctive tones and colors. If this response can, in fact, be rationalised, then there may be some basis for "color organs".

But there's always that "if", to argue about.

Do radio waves vary as they travel through different media of different colors—green, grey, red, &c.? What are the effects, if any, and how are they measured?

I'm glad in one sense that we can answer your question with a general "no", otherwise a modern suburb would look pretty drab. Or should we say—even drabber than it does?

Just imagine if radio waves could only be received properly in a grey house! But then, of course, grey isn't a color, even though it appears on the paint charts as such.

It might be possible to have a red house, however, with an outside aerial painted grey. In fact, I can see some advantages in the scheme.

Actually, Tom, radio waves—like audiotones—aren't sensitive to color but only to substances. There is more to this statement than meets the eye—and we didn't mean any pun!

In its final analysis, color isn't a tangible thing at all but merely a sensation in highly developed eyes. There are plenty of eyes from which the color sensation is missing.

Thus certain materials look red only because they absorb all light rays other than those having a particular order of wavelength. When these are reflected back to the eye, we interpret the sensation as red.

PAINTS AND DYES

A paint or dye is green only because it contains particles in suspension—or is of such a nature—that it reflects or transmits light of a particular wavelength (or combination of wavelengths).

Radio waves as we know them occupy a quite different part of the

frequency spectrum and are not immediately subject to the properties of a substance in the optical region. What are important are the characteristics of the said substance at the particular radio frequencies involved.

As we well know, copper acts as conductor and a shield at ordinary radio frequencies. We use it to wind coils, make lugs and lead, &c. The fact that it has a certain "coppery" hue is incidental.

A painter might conceivably concoct a pigment of similar hue which would be a complete insulator and substantially inert as far as radio waves are concerned.

On the other hand, a pigment containing the finely divided metal might be a partial conductor and a partial shield.

You see, Tom, it isn't the color that matters. It's the stuff!

How can I make a crystal set? What gauge of wire would I have to use?

That's the kind of question we can't very well answer in these columns, Tom, because the building instructions can't be contained in a few paragraphs.

We suggest you go through your



In morbid black

any positive result, as far as we know.

Color, as such, doesn't affect the propagation of sound at all. It doesn't matter two hoots whether your living-room is decorated in white, in wine or in what-not. A blind man would never know the difference.

It's the texture of the furnishings that matters, not the color.

But to those with sight, color is important aesthetically. A person with a soul for good music is not likely to be unaware of color harmonies, &c.

Some go a lot further—and this is where the arguments arise. They suggest that there is an actual physical relationship between hue and frequency. That a given tune can be "played" in color just as legitimately as it can in sound.

Exponents of this theory have



A more decisive fate

back issues or borrow them from someone else. You'll find various articles on crystal sets, which should give you all the required information.

Looking through the index, we suggest the following issues: August, 1954; September, 1952; March, April and May, 1951; May, 1950; and April, 1948.

If you can't locate any of these issues, we can supply a circuit through the 2/- query service, together with wiring diagram and coil data.

Can I make a crystal detector and a catwhisker?

If you could do so, Tom, we could

well imagine that the instructions would start this way: "First catch our cat..."

In the old days, people used to dabble around with all kinds of odds and ends, with the idea of making a detector. They would rake around or shiny bits of "carbon", melt lead and sulphur in spoons (if the spoon didn't melt first) try mysterious solutions in bottles and so on.

Some worked, but plenty of others didn't.

Nowadays, nearly all crystal-set builders have given away such devices and even the traditional cat-whisker and the lump of galena. Nearly everyone buys a modern germanium diode, which solders into the circuit like a resistor, needs no further attention and works better than all the old devices put together.

NOT WORTH WHILE

No, Tom, it isn't worthwhile fiddling with any of these old-time detectors except purely as a matter of curiosity.

Can you wire a crystal set on to a Morse code set?

You had us completely tricked with this question, Tom, because we couldn't fathom out what you had in mind. Then we read your next question and light dawned.

I would like to make a small, economical radio transmitting and receiving set. How could I make one?

You couldn't, Tom, without knowing a lot more about things than you apparently do — and you shouldn't either.

It seems to be an almost automatic reaction that young fellows who become interested in radio begin immediately to think about a little transmitter to talk to their pal across the way.

Time and time again we've stressed the fact that no person can legally operate any form of transmitter unless he and/or his station is licensed by the Postmaster General's Department.

We've even run a sketch on these pages showing Tom in one of Her Majesty's prisons as a result of just such a misdemeanor.

Perhaps we should get our artist to suggest a more decisive fate!

The point is, Tom, that radio transmitters have to be carefully designed so that they will radiate signals only on the officially allotted frequency. There must be some good reason also for their existence.

NEED FOR CONTROL

If all and sundry were allowed to put any kind of transmitting equipment on the air, the position would become so chaotic that essential services would be seriously hampered — if they could operate at all!

The sort of scheme you have in mind will not work, Tom, but even if it could, you could not use it legally.

What is a magnetic pickup? What does it pick up anyway?

We thought you were "having us on", Tom, when we first read this question. Perhaps you are, but here goes:

In everyday radio terminology, a "pickup" is a device used to play gramophone records. Instead of generating sound waves directly, it

generates an electrical signal instead. This is fed into an amplifier of the "pickup" terminals of a radio receiver and is made audible as sound through the loudspeaker.

A "magnetic pickup" is one in which magnetic principles are used to change the vibrations of the stylus point into electrical signals.

In heavy engineering, there is one other device which might conceivably earn the name "magnetic pickup".

It is a large energised magnet attached to the end of crane rope. When lowered among iron and steel scrap, and the current is switched on, the scrap metal adheres to the magnet and can be lifted by the crane.

The scrap metal is then swung over the truck in which it is being loaded, the current through the magnet is switched and, hey presto, the scrap is dropped into the truck, without being touched by hand.

But that's probably not the kind of pickup you have in mind.

Could you please explain why I can receive a certain station on the shortwave band of my dual-wave set. The puzzling thing is that I cannot receive it on the broadcast band where it should be. I am near three broadcasting aeriels?

The answer to your problem is almost certainly bound up in the last of the question—your proximity to other stations. But let's explain the whole matter and you will be able to judge for yourself.

A broadcast station radiates nearly all its energy on its allotted frequency—in this case in the broadcast band. A very small amount of energy will be radiated at harmonics of the fundamental frequency, that is to say at twice, three times, four times the fundamental and so on.

HARMONICS

By law, however, the amount of power in these harmonics should be kept very small, so that they should not be audible on a sensitive receiver more than a few miles or even a few hundred yards from the transmitting aerial.

If the station in question is in another district, then you should not be able to receive any signal from it on the shortwave band of your set. If you hear the signal consistently, maybe the station engineer would like to know about it.

If, on the other hand, you only heard it on a particular occasion, it may have been the result of some mis-adjustment which has now been corrected.

Perhaps the station has a shortwave outlet, Tom; a shortwave transmitter which radiates the same programmes as on the broadcast band. Some Australian shortwave stations do carry programmes selected from the National system and something similar may be done in New Zealand.

It would certainly be the most logical explanation, because a properly radiated shortwave signal could easily penetrate into areas where the broadcast signal was not audible.

If it isn't a shortwave broadcast, then we would have to fall back on the idea of a spurious harmonic or some curious heterodyne effect with

(Continued on Page 103)

COMPLETELY SELF-CONTAINED BATTERY-OPERATED

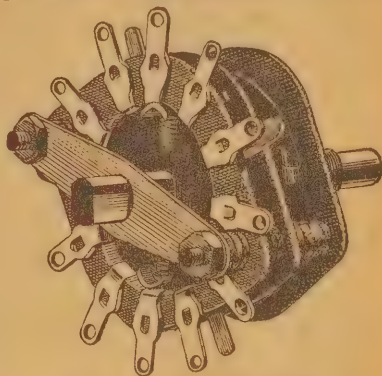


Power Megaphone for amplifying voice and conveying instructions over distances up to 500 yards or more. Weight, including batteries 7lb 4oz. Height 19 1/2 in. Diameter of flare 11 1/2 in.

JERICHO

POWER MEGAPHONE

AMALGAMATED WIRELESS (Asia) LTD.,
47 York St., Sydney. B0233.
167 Queen St., Melbourne. MU9161.



PALEC 10 AMP. ROTARY SWITCH

(World Patents pending)

GENERAL: It is the only Single or Multi-Pole Rotary Selector Switch which combines 10 Amp. current capacity with small physical dimensions. It is interchangeable and can be used in conjunction with an "Oak" type assembly.

Mechanical Operation Test. The Palec Switch has withstood 50,000 revolutions at 60 R.P.M. without mechanical failure.

RATING—10 Amp., 250 V.A.C.

CONTACTS—

Silver Plated—non-shorting only.

Resistance—800 Micro-Ohms.

TEMP. RISE ON CONTACTS—(with 10 Amp. Conductors)

at 10 Amperes	10° C. rise
at 20 "	30° C. rise
at 30 "	50° C. rise

DECKS—1 to 8 max.

POLES PER DECK—

1 Pole—max.	12 contacts
2 Pole—max.	6 "
3 Pole—max.	4 "
4 Pole—max.	3 "

OVERALL DIAM., 2-1/16 in.

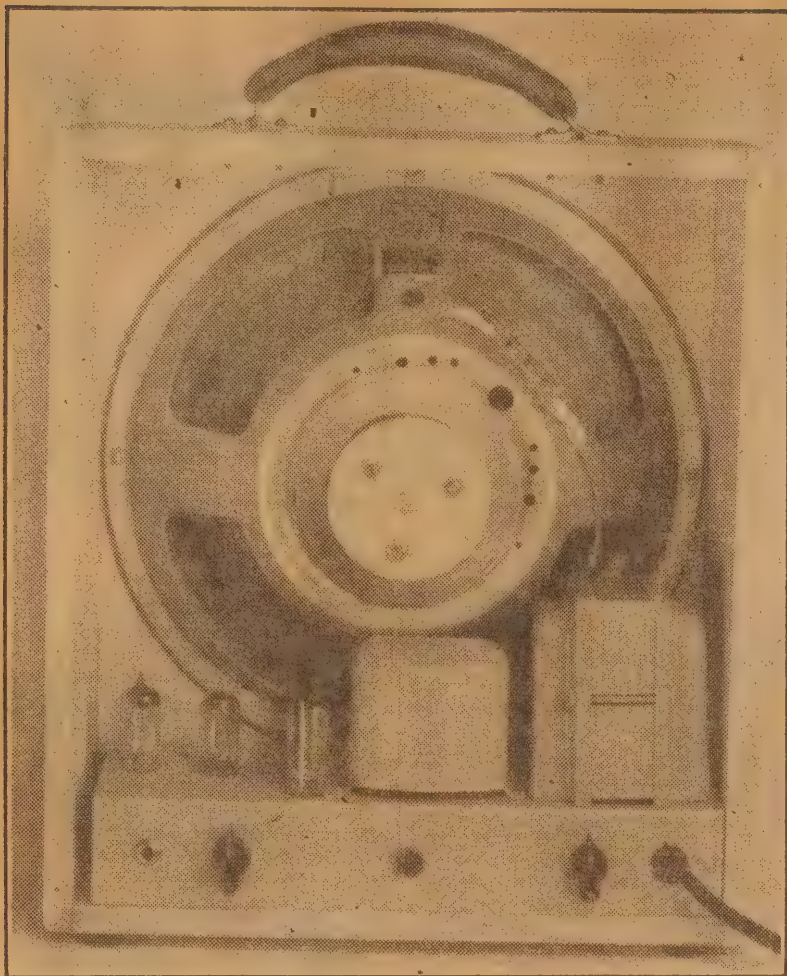
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We will design and build Switches to requirements. Available—leading Wholesalers.

Quantity prices on application to

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Rear view showing the speaker and amplifier in the case. On the left is the input socket, then the volume control, indicator bezel, and tone control on the right. Note how one corner of the power transformer is accommodated in the speaker frame cut-out.

on a flat board, stained and polished to make it look the part.

All the output comes from the amplifier and loudspeaker.

The volume and "tone" are readily controllable, just as in an ordinary radio set. The player can use the instrument "straight" or he can give prominence to the bass rhythm. He can make "chirping" noises with the treble strings only, or achieve sustained "singing" effects by suitably manipulating the gain control.

Most important, from his point of view, is that he can always be heard in association with other instruments.

In setting out to design this amplifier, we decided that one of its main requirements should be an adequate power output, even under not-so-good conditions.

TYPICAL TYPES

A check with various people who make, sell and use these things revealed that there are, roughly, two classes of amplifier available. One is a fairly simple single-ended design with a power rating of about 4 watts, and the other a rather more elaborate one, featuring push-pull output valves and with a power rating in the general region of 10 to 12 watts.

The advantages of the smaller job would be a lower cost and a smaller, lighter amplifier. On the debit side there is some doubt whether the

AN AMPLIFIER FOR A GUITAR

Many readers should be pleased to see this long-awaited article on an amplifier specially designed for use with electric guitars. It is powerful and efficient and can be built for a much lower figure than you'll pay for any comparable commercial unit.

OVER the past few years there has been a tremendous increase in the popularity of electric guitars, and they have become an almost standard instrument in stage presentations and small musical groups.

The guitar has always been a popular instrument, of course, even in its original form. It has suffered, however, from rather low acoustic output, which has limited its use for anything much more than vocal accompaniment.

The provision of an amplifier overcomes this problem in no uncertain fashion, and it also allows effects which cannot be achieved—or usefully achieved—in the ordinary acoustic instrument.

While it is possible to use standard or contact microphones with a guitar,

the more usual practice nowadays is to provide electromagnetic pickup from the steel strings, thus avoiding all the feedback problems which are usually associated with microphones.

In fact, the most modern electric guitars have no "sounding board" at all, being acoustically quite dead. They are simply an assembly of strings, bridge and tuning mechanism

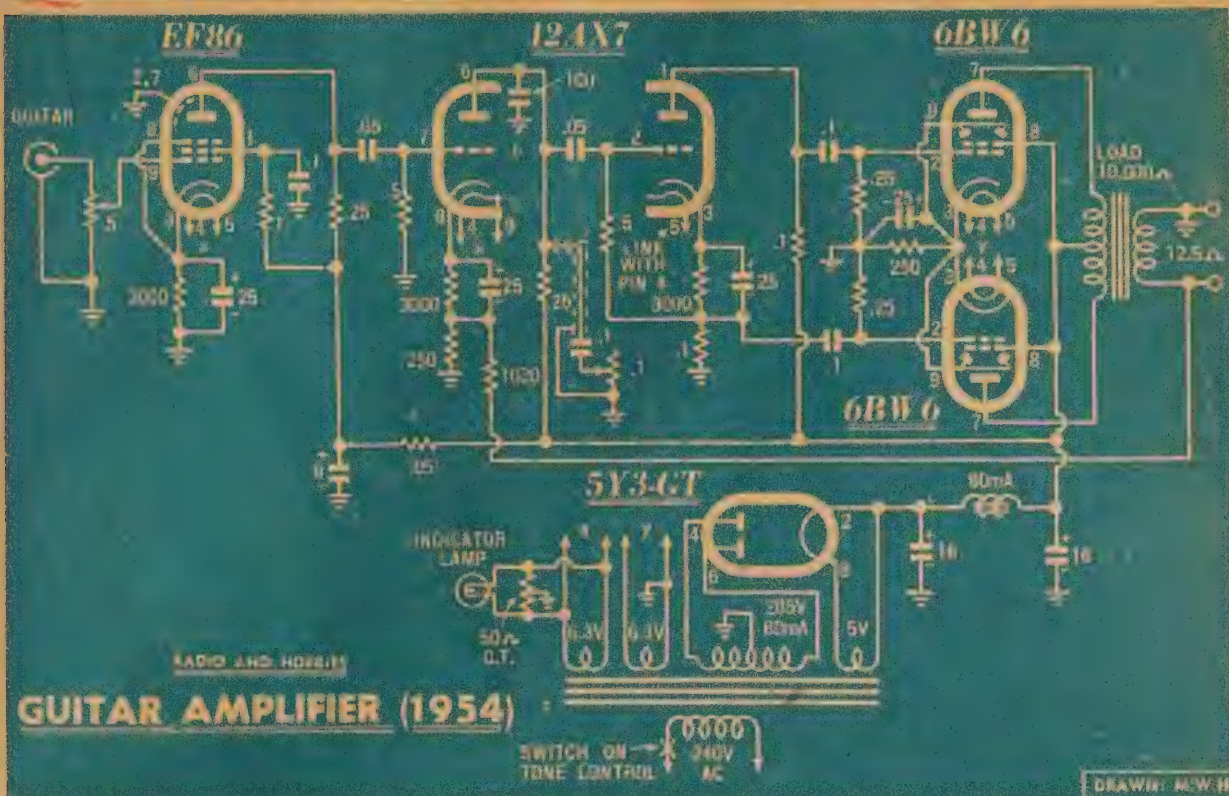
power is sufficient for all situations, though it should be adequate for private performances and small halls.

The larger amplifier naturally costs more and will be a little heavier but, with a good speaker, should have just that extra power to enable it to work comfortably where the smaller one would fail.

There is also a suggestion in musical quarters that the "Spanish" guitar requires more power to do it justice than does the "Hawaiian" guitar. The exact reason for this is not clear, though it may well be that the method of playing the former produces more severe peaks as the string is plucked, thus making essential an amplifier which can handle these peaks without being driven into the overload region.

by Philip
Watson

CIRCUIT IS SIMPLE — AMPLIFIER HAS HIGH GAIN



GUITAR AMPLIFIER (1954)

The circuit is quite straight forward and follows well-tried practice. The use of a feedback loop from the speaker transformer secondary is possible with a medium quality transformer by reason of the lower gain in the main amplifier.

In the light of these facts, we decided that the larger push-pull version was most desirable, since it should then be capable of handling either type of instrument and still give adequate volume. Its cost, built at home, would still be lower than even the simpler commercial units.

Sensitivity was the next question. This must be sufficient not only to allow the lower notes (which normally have the highest level) to drive the output stage close to maximum output, but also to have some reserve for special "effects". This may involve playing the treble strings only, and with the amplifier operating at a sensitivity which would cause severe overload if the bass strings were played.

VOLTAGE OUTPUT

The actual voltage output from these devices will vary a good deal from one make to another, but it does seem that most of them will produce a peak of about 250 millivolts (one quarter volt). This is indicated by the fact that most of them will operate directly into the "pickup" terminals of an ordinary receiver, though with nothing to spare in the way of gain.

This was confirmed by tests in our own laboratory, where a typical commercial instrument operated reasonably well into an amplifier having a sensitivity around 350 mV. However, there was nothing to spare and it is doubtful if the full output of the amplifier would be achieved under ordinary playing conditions.

On this basis, and to ensure that the amplifier would be truly universal, it was fairly obvious that something more was required than the simple driver, phase-changer combination, which would need to operate flat out all the time. In short, some form of pre-amplifier stage appeared to be essential.

Weight and size had also to be considered, it being fairly obvious

that the unit must at least be comparable in portability with other musical instruments. At the same time there is not much point in providing an adequate amplifier if its performance is to be spoiled by a mediocre speaker, and a 12in-type, with a good magnet, appears to be the logical choice. This is particularly so since the next smallest size is now the 8in. variety.

PARTS LIST

- 1 chassis 12in x 5in x 2in.
- 1 Power transformer. 285V. 80mA. 6.3V 2A 6.3V 2A. 5V 2A.
- 1 12in speaker.
- 1 Speaker transformer 10,000 ohms, suit speaker.
- 1 Filter choke 80 or 100mA.
- 1 5Y3 valve.
- 2 6BW6 valves.
- 1 12AX7 valve.
- 1 EF86 valve.
- 4 Miniature 9-pin sockets.
- 1 Octal socket.
- 1 Miniature 4-pin speaker socket and plug.
- 1 Indicator bezel and lamp socket.
- 1 6.3V lamp.
- 2 Pointer knobs.
- 1 Input jack.
- 2 3-terminal tag strips.
- 2 5-terminal tag strips.
- 2 8-terminal tag strips.

RESISTORS

- 1 1 meg. 1W.
- 1 .5 meg pot.

- 2 .5 meg 1/2W.
- 2 .25 meg 1W.
- 2 .25 meg 1/2W.
- 1 .1 meg pot. with switch.
- 2 .1 meg 1W.
- 1 .05 meg 1W.
- 2 3000 ohm 1/2W.
- 1 2000 ohm 1/2W.
- 1 1000 ohm 1/2W.
- 1 250 ohm 3W.
- 1 250 ohm 1/2W.
- 1 50 ohm CT 3W.

CAPACITORS

- 4 25 mfd 40V electrolytics (midget)
- 2 16 mfd 525V electrolytics
- 1 8 mfd 525V electrolytic
- 4 .1 mfd 400V paper
- 2 .05 mfd 400V paper
- 1 100 pf mica.

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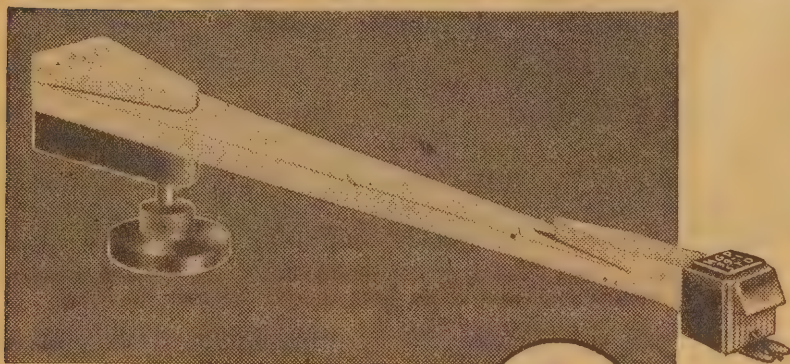
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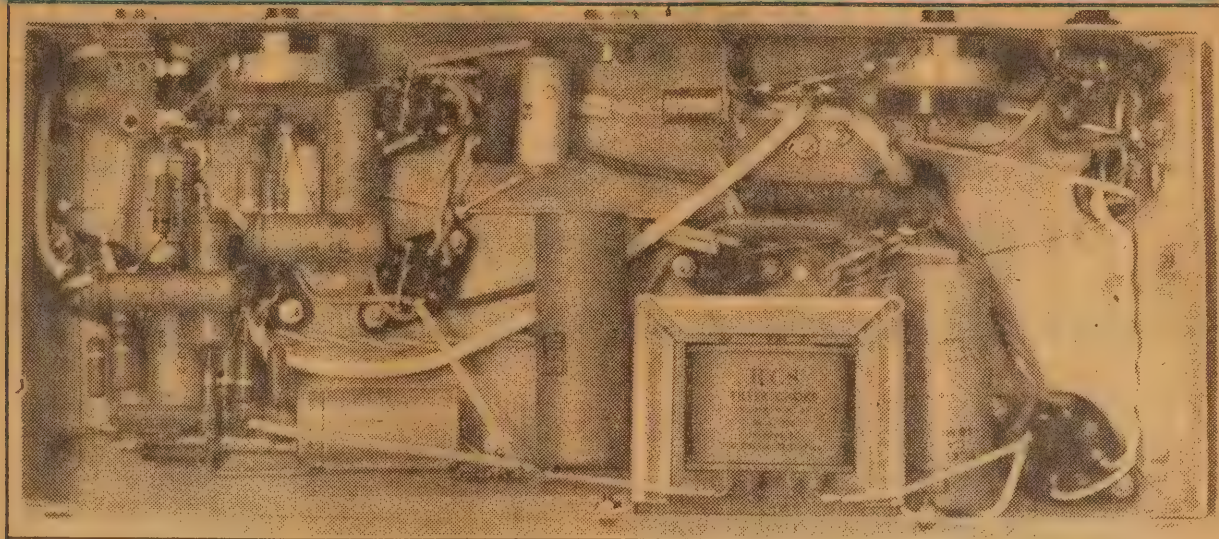


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The underside of the chassis. Top left is the input socket with the volume control alongside it. The EF86 socket is at the left, the 12AX7 to the right of it, and the 6BW6's to the right again, one above the other. The rectifier is in the lower left corner.

By using miniature valves and components, some reduction in amplifier size is possible, but the limitation here is the size of the power transformer, output transformer, and filter choke.

Assuming a push-pull circuit, there is not much that can be done to reduce the current drain below 80 mA and this rating governs the choice of the power transformer and filter choke. The output transformer could be a very small type but, once again, we would be throwing away power and performance which we strive to achieve in the amplifier.

We finally settled for the largest available conventional speaker transformer. It may not be quite as good as a specially-designed one, but it is quite adequate and costs very much less.

AMPLIFIER DESIGN

Reference to the circuit will show the finer points of the final amplifier design. The output valves are 6BW6's (miniature 6V6's) and are operating in class AB1. This provides a power output of 12 watts.

The two sections of a 12AX7 operate as a driver stage and phase changer respectively, and the sensitivity at the grid of the driver is about 300 mV without feedback.

This may be enough with instruments having slightly higher than average outputs. On this basis, the design of the amplifier could be simplified considerably, assuming that the builder knows the capabilities of his instrument.

Where there is some doubt about the output, or it is required to use the amplifier with a variety of instruments, it would be better to follow the original design and provide the pre-amplifier stage.

This consists of a EF86 low-noise pentode and is capable of providing enough sensitivity for virtually any type of instrument likely to be encountered. Since there is really more gain than is likely to be required, we can even afford to throw some of it away by means of negative feedback,

thus contributing to better overall amplifier response, lower distortion, and better speaker damping.

FEEDBACK CIRCUIT

The feedback network runs from the speaker transformer secondary to a tapping on the driver stage cathode resistor network. This is similar in general principle to that used in the "Playmaster" amplifiers and is particularly effective. However, it normally calls for a better-than-average output transformer if the system is to be free from the complications of phase rotation at very high or very low frequencies, with consequent instability.

In this case we are able to use the system with one of the cheaper transformers by reason of the lower gain provided by the triode driver.

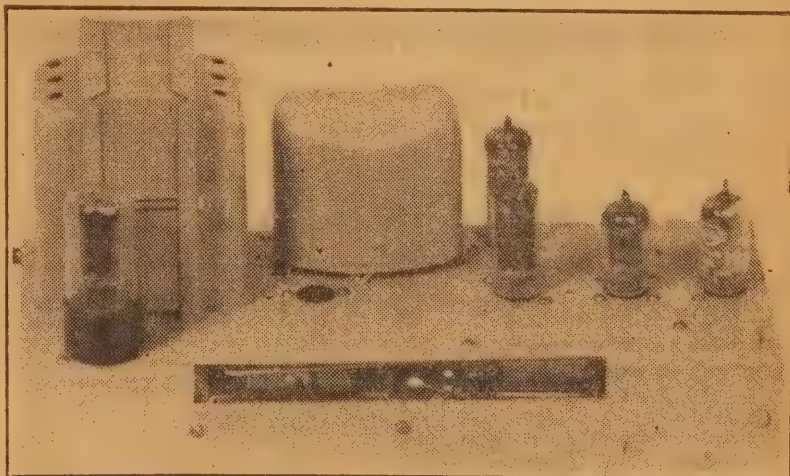
The exact amount of feedback used is not particularly critical and it could be increased or decreased ac-

cording to individual requirements. However, the values shown will work out correctly in most cases and still provide adequate sensitivity.

In the event of a speaker being used which has other than a 12.5 ohm voice coil, the 1000 ohm feedback resistor may be modified as follows, to give the same order of feedback: For 8 ohms, 800 ohms; for 2 ohms, 400 ohms.

It will be noticed that the volume control is located in the grid circuit of the pre-amplifier. This was done to prevent possible overload of this stage in the event of the guitar itself having no built-in volume control. In these circumstances, it would be possible for the bass strings to generate enough signal to run the risk of pre-amp. overload.

Modern controls appear to be quiet enough to justify their use in such a position, remembering that it is not usual to operate this while playing,



This top view gives an excellent idea of the layout of major components. Note that the speaker transformer is mounted at right angles to minimise hum pickup. In front of the speaker transformer is the four pin speaker socket. The cut-out in the chassis accommodates the lower edge of the speaker.

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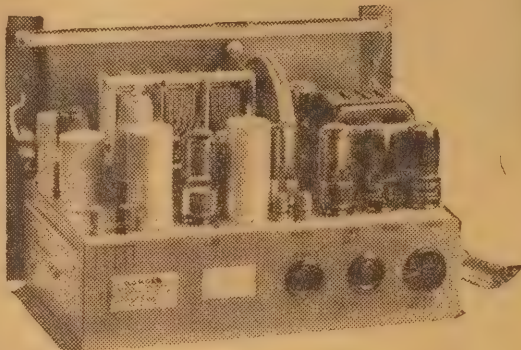
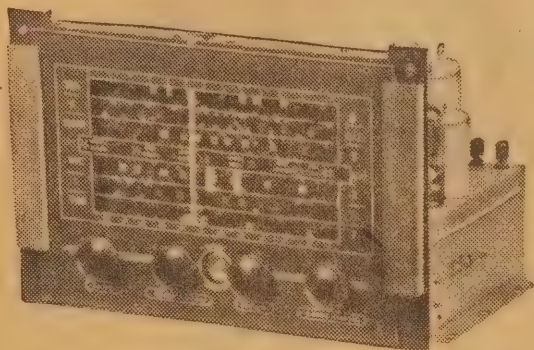
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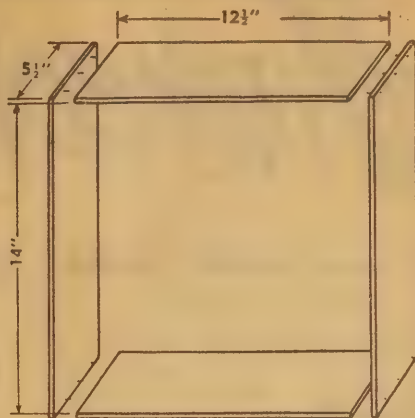
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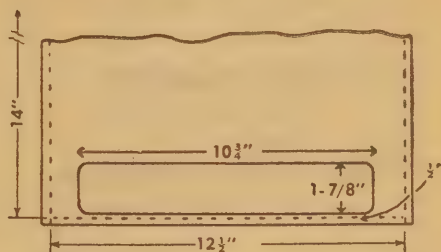
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Page Sixty-one

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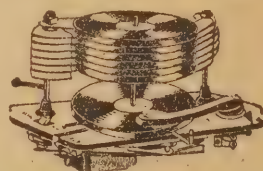
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A second five terminal strip, running lengthwise with the chassis, is mounted on the diagonally opposite bolt. This serves to terminate the filament leads for the EF86 and 12AX7 and also to mount the centre tapped resistor which goes across this circuit. Another terminal supports one end of the 1000 ohm feedback resistor, the other end being on the speaker socket.

TRANSFORMER WIRING

The HT secondary leads run direct from the transformer to the rectifier socket, as do the rectifier filament leads and the 6BW6 filament leads. The first filter capacitor mounts between the rectifier filament terminal and the earth terminal on the tag strip.

A three-terminal tag strip near the filter choke terminates the second filter capacitor and becomes the main HT terminal. The filter choke itself is actually rated at 100 mA, this being the most convenient size having an adequate rating.

In the amplifier section things are a little more compact. There is room for everything but a little more care will be necessary to accommodate all the parts logically. In some cases we used larger components than the smallest available, so the smaller types would help somewhat.

Watch particularly the placement of parts in the vicinity of the volume control and avoid crowding things to the point where the control cannot be changed without wrecking the set.

As shown in the circuit, the 12 AX7 section using pins 1, 2, and 3 is used for the phase changer and

the other section for the driver. This will ensure a logical layout. A seven terminal tag strip near the front of the chassis provides anchor points for most of the components associated with the phase changer, including the 25 mfd cathode bypass capacitor. Some terminals at the other end of this strip serve the EF86 components.

Components for the driver section of the 12AX7 are supported by a seven terminal tag strip near the rear of the chassis. This also accommodates the .05 meg. decoupling resistor, the 250 ohm cathode resistor and one end of the plate and screen resistors for the EF86.

It is desirable to provide single point earthing for the input circuit of the EF86 in order to minimise hum introduced by earth loops in the chassis. This will ensure that the maximum gain of the amplifier can be used if it should be needed.

The connections involved are the earthy end of the cathode resistor and bypass, the earthy end of the volume control, the earth pin of the input jack, and the earthy end of the screen bypass. Since the earthy side of the input jack is connected to chassis automatically when it is mounted this should, ideally, be the earth point to which the other returns are made.

INSULATED TERMINAL

To facilitate this the various returns are made to an insulated lug on the tag strip which is then connected to the earth lug on the input jack. This lug is then earthed to the main network.

A shielded lead runs from the moving arm of the volume control

to the grid terminal of the EF86 socket. This is earthed at the control's earth terminal and encased in insulating sleeving to prevent it shorting other components.

A similarly insulated length of shielded cable runs from the plate of the driver stage to a three-terminal tag strip alongside the tone control. This strip supports the .1 mfd capacitor of the tone control circuit and short leads run from it to the control.

INPUT SOCKET

The input socket is a standard jack intended to take a PMG type plug. This was chosen mainly because most guitars appear to be fitted with this type of plug. However, it would be quite feasible to use one of the completely shielded microphone type sockets if the guitar was fitted with a matching plug. These units have the advantage of being completely shielded and are therefore far less prone to hum pickup under conditions of high gain.

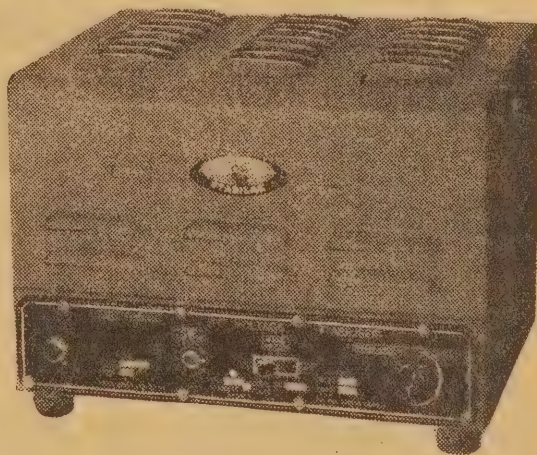
While on the question of hum it might be advisable to discuss some aspects of this problem from the point of view of the guitar user. Normally the requirements are not quite as stringent as in a high quality amplifier. For one thing the baffling is relatively poor and for another the surrounding noise level will usually be fairly high.

However, if it should prove a problem, there are a few points worth checking. In addition to the shielded input connector already mentioned, it is often possible to reduce the hum in the pre-amplifier circuit by

(Continued on Page 75)

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GETTING YOUR AMATEUR LICENCE

In this article the design and application of a standard plate modulator is discussed covering the essential points you are likely to be asked when sitting for your AOCPP examination.

AMPLITUDE modulation of the final RF stage plate circuit is easily the most popular system used today by amateur phone transmitters.

For this reason, the examiner will be most interested to find out what you know about suitable modulators, and every examination paper is certain to include a question about them.

Sometimes it will be a general question, asking for a complete circuit of a modulator. On the other hand, it may be a question about some part of it, the explanation of which will indicate whether you understand the main requirements of modulator circuits.

The average home builder studying for his AOCPP certificate will not find the subject of modulators a very difficult one. Very few enthusiasts have not built at least one amplifier for playing gramophone records, probably using a push-pull output stage and some type of phase-changer circuit.

A modulator is essentially the same thing, for its function is to amplify the output from the microphone and produce sufficient audio power to fully modulate the final stage of the transmitter.

POWER OUTPUT

The exact power output required from the modulator will depend primarily on the RF input power to the modulated stage. To modulate 100 watts input using a sine wave test signal, we will require 50 watts of audio in an ideal case to swing the RF plate voltage negatively to zero and positively to twice its normal value.

This wattage must be available after deducting any losses in the modulation transformer — assuming one is used — so that the actual audio power delivered by the output stage must be even higher.

In practice, we divide the modulator into three sections:—

1. The voltage amplifier or sub-modulator, which accepts the output from the microphone and amplifies it until it is sufficient to drive the output stage or modulator. This section will include a gain control and also a phase-changer if our output stage is push-pull connected.

2. The power amplifier or modulator proper, which accepts the voltage drive from the sub-modulator and supplies enough audio power to the modulation transformer to modulate the transmitter.

3. The modulation transformer — the most popular coupling device — which applies the audio voltage developed from the modulator to the plate circuit of the RF amplifier, and at the same time provides the correct impedance match between them.

A good modulation transformer is quite an efficient device. The efficiency of a 50-watt type will probably be about 85-90 per cent, and smaller types sometimes less.

When considering average modulator power needed to fully modulate

a transmitter, it should be remembered that the average power on sine wave input is much higher than the average power for voice. Voice waveforms contain quite high peaks — more for some voices than others. It is these peaks which must not exceed 100 per cent modulation, and to avoid this happening we must operate the modulator at reduced level to accommodate them.

For this reason, although it might be thought that a smaller modulator could be used on voice, the modulator must always be able to supply the full peak voltages without overloading.

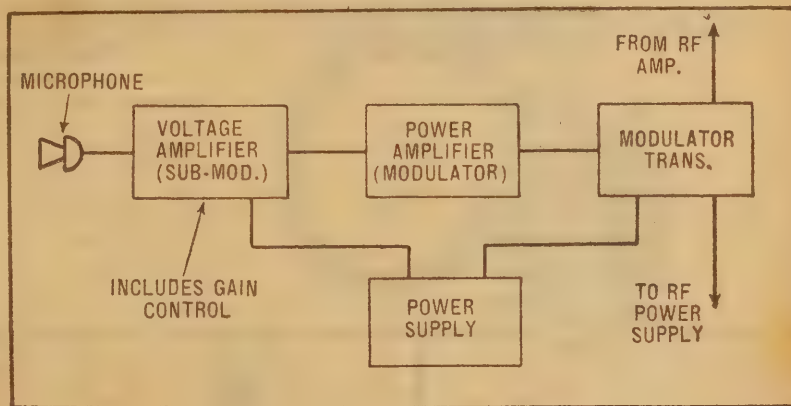
Overloading means high harmonic distortion, and the effects of such dis-

moved from band to band, or from one spot in a given band to another. Unless the current drain of the RF amplifier is adjusted each time to exactly the same figure, or the ratio of the transformer altered to suit the new current drain, the load on the modulator will be changed, and its power output also.

If the altered operating conditions cause a lowered modulator output, we cannot obtain full modulation without some reserve power to make up for the mismatch.

In considering our modulator, therefore, we have established some general requirements. These are:—

1. Enough gain in the preliminary stages (sometimes called the sub-



A block diagram of a plate modulator.

ortion can be just as objectionable in transmission as cutting the carrier, due to over-modulation.

If a modulator is capable of supplying high peak voltages without distortion, we could use a design with a lower average output, and this is sometimes done, particularly with Class-B modulators. But as a general rule, it is safest to adhere to the practice of using a modulator able to give half as much audio power as we have RF input.

EXTRA AUDIO POWER

When we use pentodes or beam power valves in the RF amplifier, we must supply enough audio power to modulate the screen as well as the plate circuit. For this reason, the modulator in such a case should be a little more powerful than if we used triodes in the transmitter, although the difference does not amount to more than a few per cent.

This discussion assumes that the modulation transformer ratio is correctly selected to match the modulator output stage to the RF amplifier. If it is not, we may find that our full audio power is not being obtained.

In practice, a mismatch happens quite frequently as the transmitter is

modulator) to drive the output stage to its full capacity from the particular microphone we select.

2. Enough power output from the output stage (the modulator proper) to modulate fully the RF input of the final amplifier.

3. A matching device, such as a modulation transformer, to match the load represented by the RF amplifier (plate volts divided by plate current) to the load required by our modulator valves to give the amount of audio we want.

4. Enough reserve power in the modulator output to make up for losses in the modulation transformer and for occasional mis-matches which may occur in practice, due to variation in RF amplifier loading.

5. For voice communication, less audio is needed for full modulation than for a test sine wave input, but if we accept the figure for the latter condition — an audio output equal to 50 per cent the RF input — we will automatically provide about the right amount of reserve power to allow for the losses mentioned above.

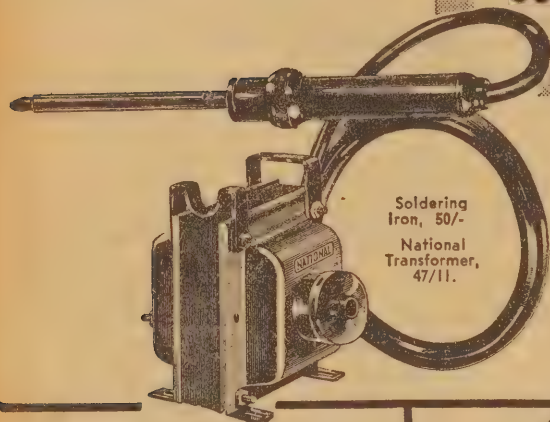
Figure 1 shows a block diagram of a modulator indicating the function of each section.

A practical modulator circuit, of the type you might be expected to

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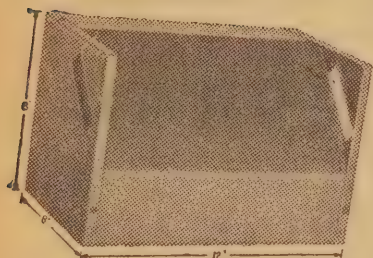
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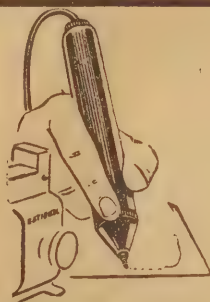


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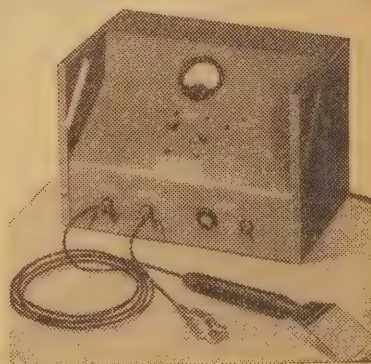
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produce in an examination, is shown in Fig. 2.

Such a modulator would be suitable for use with a diaphragm-type crystal microphone, and will give an audio output of 34 watts, according to the valve-maker's specifications. The operating conditions given are taken from tables for the 6L6, but they will apply equally to the 807, which is even more robust.

The circuit would be the same if used with lower voltages than those shown, but the power output would not be as great.

There is reason to believe that these conditions no longer hold good for the 6L6, which tended to arc across the base at high ratings. The 807 does not suffer from this disadvantage, and the ratings are therefore quite valid and useful for it. They are, of course, not the only ones suitable for the 807.

GENERAL DESCRIPTION

In terms of general description, the circuit commences with a high-gain pentode pre-amplifier valve, the grid of which is fed by the voltage developed across its 5 meg. grid resistor from a diaphragm-type crystal microphone. Other microphone types may be used, but we are considering the crystal microphone in this case.

The output from the pre-amplifier is fed via a gain-control to the grid of the second valve, which is a triode connected in a phase-changer circuit.

The valve shown is a pentode similar to that used in the pre-amplifier, but connected for triode operation. In practice, almost any small triode valve can be used in its place.

The phase changer supplies the voltage drive for the push-pull output valve grids, one being driven from its plate circuit and the other from its cathode circuit. The voltages appearing at these points are equal in amplitude but opposite in phase, which is what we require for push-pull operation. A more detailed description of the phase changer will be given later on.

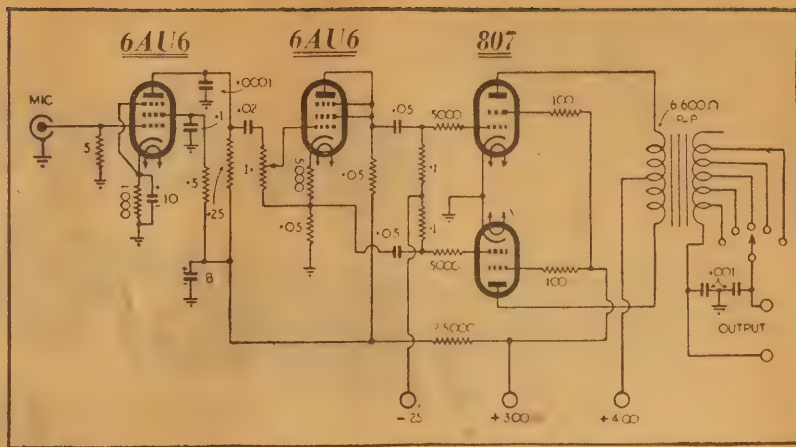
The output or modulator stage uses a pair of 6L6 or 807 valves connected for Class AB1 operation, which means that although they are biased to a greater amount than for Class A the grids are not driven sufficiently positive for any grid current to flow. There will, however, be a rise in plate current when the stage is operating. Plate current is given as 102 mA for zero signal and 152 mA for maximum signal.

POWER SUPPLY

You will not usually be asked to include a power supply for the modulator, as this may take various forms. However, a straightforward circuit could be used with a transformer having a rating of 350 or 385 volts per side of the centre tap and with a current rating of 150 mA. A robust rectifier such as the 5V4-G would be used.

Such a supply would probably give a little more than 400 volts with capacitor input, but this will be OK if the screen voltage is reduced by about the same amount as the plate voltage exceeds 400 volts.

The screen circuit and the high tension circuits of the first two valves can be fed by a dropping resistor of adequate wattage from the high tension supply. A bleed resistor to earth of about 25,000 ohms from this point will help to stabilise the 300 volt point, as the voltages from the supply



A typical modulator circuit for use with a crystal microphone used under the conditions shown, it will give an output of 34 watts at the primary with a well regulated supply. Secondary taps are provided to allow correct matching to the transmitter. The input lead from the microphone should be well shielded. Battery bias can be used.

will drop a small amount as the plate current varies with modulation.

A transformer having a secondary rating of 350 volts per side will probably give just about 400 volts when the modulator is not handling a signal.

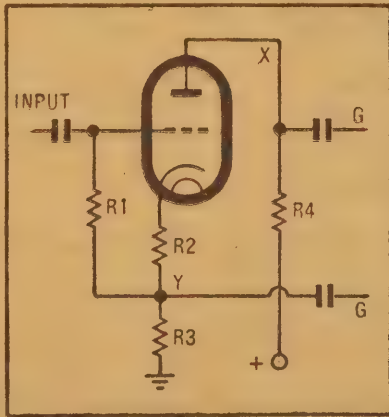
A low resistance filter choke should be used with the supply, having a resistance of only a few hundred ohms. The lower the resistance the better will be the regulation. Its value need not be more than about 10 henries as the hum level for the modulator need not be as low as we expect to find in a gramophone amplifier, for instance. A pair of 16 mfd 600 volt peak electrolytics will handle the filtering. A third capacitor of 16 mfd or higher should be connected from the 300 volt point to ground to provide a low impedance bypass for the screens.

Now for some more detailed comments on the circuit stages.

PRE-AMPLIFIER GAIN

Assuming an applied voltage of 300 for the 6AU6 pre-amplifier, this stage will have an overall gain of 230 and a voltage output of 108 volts. In fact, it will have something less than 300 applied volts, which will reduce the output voltage slightly but will not materially alter the voltage gain.

This means that for one volt input the stage can give more than 100



The essential circuit of the phase-changer used in Fig. 2.

volts output, to drive the phase-changer.

The gain in the phase-changer is about 1.8 times, so that the output from the pre-amplifier will need to equal about half the drive needed by the output grids.

A push-pull circuit calls for a grid driving voltage of about twice the bias, so that 25 volts are required from the 6AU6.

INPUT VOLTAGE

In this circuit, the 6AU6 will give 108 volts with a gain of 230, and a little calculation will show that for 25 volts out an input of about .125 volts is needed at the grid with the gain control wide open. The average crystal microphone will normally give this amount on peaks across a 5 meg load, so that we should not require any further pre-amplification. If we do, a resistance coupled low-gain triode should easily make up the difference.

All these figures are approximations, but they serve to illustrate how we go about calculating what is required of the pre-amplifier stage.

The phase changer requires a little more comment because a question asking for an explanation of its operation is frequently found in examination papers.

As will be seen from Figure 3, the circuit of the phase changer is the same as that for an ordinary triode amplifier, except that a resistor R3 is connected between ground and the point Y, which is normally earthed. And it will be equally plain that the current drawn by the valve will flow through this resistor as well as through R2, the bias resistor, and R4, the plate load resistor.

THE PHASE-CHANGER

For the purposes of discussion we can neglect R_1 , which is the grid resistor, and R_2 , which is a cathode bias resistor, both of which operate essentially in the same way as in a normal amplified circuit.

Assume that we have enough current flowing in the circuit to cause a voltage drop across R4 of 100 volts. Because R4 and R3 have the same value, and because the current flowing through them must always be the same, we will also have a voltage

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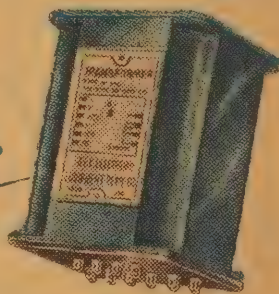
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drop across R3 of 100 volts. Now assume we apply a positive voltage to the grid of the valve, so that the increased current flow in the plate and cathode circuits is enough to increase the drop across R3 and R4 to 110 volts.

At point Y the voltage will increase, for whereas previously Y was 100 volts positive, it now becomes 110 volts positive.

But at point X the voltage will decrease by 10 volts, because if the supply voltage remains the same, as it does, and there is an increased voltage drop of 10 volts across R4, there will be 10 fewer volts left at the plate of the valve.

Conversely, if we apply more negative bias to the grid of the valve so that the voltage drop across R3 and R4 is only 90 volts, point X will drop by 10 volts, but point Y will rise by 10 volts, because there is 10 volts less drop across R4 than before.

LOW-STAGE GAIN

If you ponder over these points, for a few moments, you will see that any changes in grid voltage applied to the valve will cause equal changes in voltage at points X and Y, but these changes will have opposite signs. When one goes positive, the other goes negative. And if we connect the grids of two push-pull valves to points G1 and G2, we will have the necessary push-pull voltages supplied by the phase-changer.

The presence of R3 in the cathode circuit of the phase-changer causes a large amount of negative current feedback, which is the reason why the gain is so low. It is in fact twice as much as if the valve were to be

used as a cathode follower, because we have two load resistors instead of one. The valve therefore accepts the input voltage from the pre-amplifier, splits it into two equal parts of opposite phase, and hands it on via the coupling condensers to the grids of the output stage. Each valve receives a voltage drive equal to .9 of the input voltage to the phase-changer grid.

This is not the only type of phase-changer which can be used in this circuit, but it is probably the most common, and is the simplest to understand and to describe for examination purposes.

The output stage is quite straightforward. Reading from the valve specification we find that the load impedance for this circuit is 6600 ohms, and we must therefore adjust the matching to the RF amplifier by selecting appropriate tapings generally provided on the modulation transformer.

These tapings are most commonly found in the secondary of the transformer, although in order to make best use of the available windings, taps are often included in both windings.

The important thing is to see that the correct ratio between the windings is preserved.

For instance, if the RF amplifier ran at 600 volts and 100 mA., the secondary impedance would be 6000 ohms and a 1-1 match would be in order.

But if it ran at 1000 volts and 100 mA., this would represent a secondary impedance of 10,000 ohms, and a step-up of about 1.6-1 would be needed.

As a precaution against parasitic oscillation, grid and screen suppressor resistors are shown, but these are not always required.

The bypass capacitors across each side of the secondary serve to limit the high frequency response of the modulator beyond the speech range, which again is a precautionary measure. A great deal could be said about tailoring audio response of modulators, but it is beyond the immediate scope of the subject.

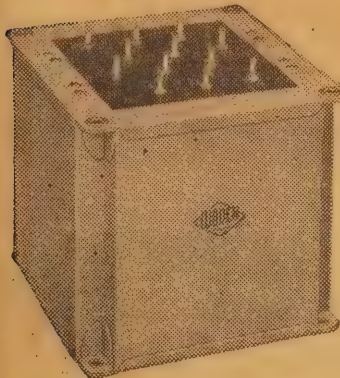
This circuit is not suitable for Class B modulators, which are frequently used in amateur work. With a Class-B circuit the grids of the output valves are biased back to cut-off and then driven well into the positive grid region, in which they will draw appreciable grid current.

For this reason it is essential to use a low impedance grid circuit and to feed the valves from circuits having an equal impedance.

Neither of these conditions is met with our circuit. The grid impedance measure thousands of ohms instead of hundreds, and the impedance at the phase-changer plate is comparatively high, while that at its cathode is very low. This circuit is only useful when no grid current flows in the modulator.

Class-B circuits often use 807's connected as triodes, although more often special high-mu triodes are employed. The driver valve must be capable of supplying enough power to satisfy the modulator grid circuit requirements, which will often run to 5 or 6 watts. This is another reason why a driver transformer is almost always used.

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Let's Buy An Argument

In the clean-up which followed the completion of the last issue, I was just about to screw up a big table of figures, when I thought better of it. They were figures I had recorded of output and frequency response from a variety of crystal pickups.

THE figures were taken, in the first instance, purely to provide background information for last month's article on crystal pickups. I wanted to know something about their output voltage and their general behavior with various values of load.

There was no intention to publish or identify the curves, because they were taken on individual pickups which may or may not have been fair samples of the particular make and type.

However, looking at the figures once again, I realised that they had an interesting story to tell, quite apart from their actual identity. They are, in fact, curves of actual pickups which the public is buying and using right now.

POPULAR TYPES

Most of them are universal or turnover types, as fitted to playing decks and record changers.

While, at first glance, they may appear as a hopeless jumble of lines, one can trace in them the influence of the same basic design factors.

They are, in fact, largely variations on a theme.

The point is seen most clearly in figure 1, which shows the actual uncorrected output from four different types of pickup, feeding into a 0.5 meg. load and playing the Decca microgroove test record LXT 2695. The curves were not specially selected but happened to be the first four to be drawn.

Over the centre portion of the range, the output tends to decrease with rising frequency, corresponding to that portion of the recording characteristic, which most nearly approaches a "constant velocity" law.

The "dip" in the characteristic continues into the 2 to 4 Kc region,

after which the output rises in obvious fashion toward the main treble resonance.

Beyond that again, the response falls right away, rising again to secondary (and usually minor) resonance effects above 10 Kc.

At the bass end, the change in recording characteristic toward a "constant amplitude" law arrests the rise in output and produces a bump in the characteristic at around 500 Kc.

EXTREME BASS

The slope below that is affected somewhat by the relationship of pickup capacitance to output load. Last but not least, the influence of arm resonance is likely to add a sharp roll or kink in the region of 40 to 50 cycles.

That might be a rough and ready summary of what goes on but we find that crystal pickups follow the same basic pattern with monotonous regularity.

You can see the same factors operating in the curves of figure 2, though they happen to represent extremes of one kind or another.

Curve "E" is true to form except that the manufacturers have "wangled" the damping and compliance to keep the main treble peak close to zero reference with respect to 1 Kc. This is a mixed blessing,

however, because it does not leave a gaping hole in the curve at about 2 Kc.

Curve "F" is unusual in that the secondary peak around 10 Kc, assisted by the recording characteristic, is a trifle higher than the fundamental peak at 5 Kc. The bass end trails off rather badly, however, and I tip that this particular pickup would have turned out a better-looking curve with a 1.0 meg. rather than a 0.5 meg. load.

OTHER LOADS?

As we explained last month, we didn't have the time to investigate all the possible loading and compensation arrangements suggested by various manufacturers. We had to stick to the simple 0.5 meg. load because it saved time, it showed the peculiarities of individual pickups and it's the way most people use them.

And what can we say of curve "G"? Compared with the others, it looks terrible—but let's look again.

Its whole position on the graph is elevated because the 1 Kc point happens to coincide with a trough

by **Neville Williams**

in the response, and the entire lower and middle register is, therefore, above the reference line.

As far as the ear is concerned, the curve could be lowered bodily by 2 to 3 db, which, would make the bass end coincide with the reference line and lower the treble peak from 13 to 10 db.

Of this 10 db, 5 comes from the record, in the guise of pre-emphasis and would be cancelled by suitable adjustment of the tone control. That leaves an effective 5 db peak at 4 Kc, which is a very different proposition from the 13 that one sees at first glance.

LESS DAMPING?

It would seem that this particular pickup has less inherent damping than the others, possibly due to its design or perhaps due, in part, to some of the "goo" having leaked out of the cartridge.

With extra damping, the trough and the peaks would probably move higher in frequency and be lowered at the same time, bringing it more into line with the others.

In the meantime, however, it's certainly different!

Leaving, for a moment, the "why" and the "wherefore", one might raise the question . . . "Which would be the best of these pickups to buy?"

On the surface, it should merely be a matter of finding the one with the straightest curve and buying that one. In one sense it would be the best but it may not sound the best to everybody!

Pickup "D" would probably sound fine with a good average 12in speaker, because it is quite smooth over most of the range and the 9Kc peak would fill in where the speaker response drops away.

It might, however, sound very "hissy" (what a term!) with some of the wide-range speakers, which often seem to give prominence to the 8 to 10 kc region. Pickup "A" or even "F" might be preferred with such speakers because they would give greater comparative weight to the middle register.

PERSONAL PREFERENCES

Then, of course, there is the question of personal preference — those who like "bright" or "mellow" tone. And we haven't even mentioned the all-important subject of distortion, nor the possible variations between pickups of the same brand and type.

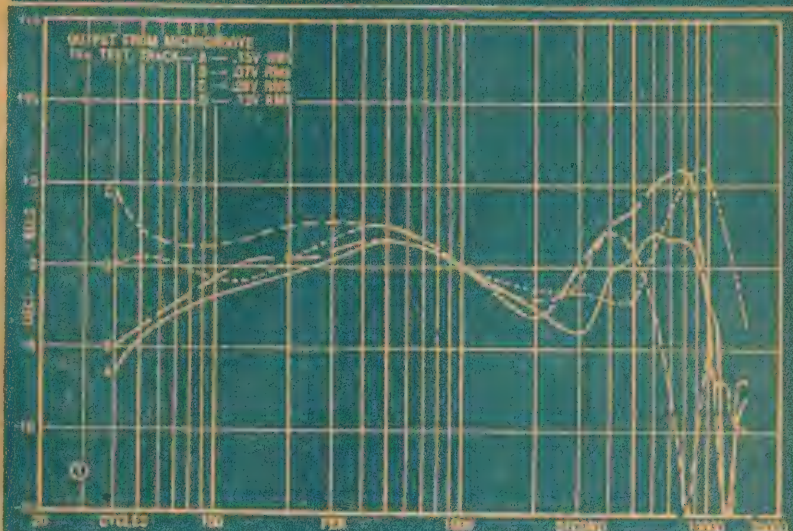
No it isn't easy to select a pickup which will unflinchingly appeal to somebody else as "the best".

For another thing, the curves show very clearly why we cannot design a universal correction filter for crystal pickups, as some would apparently like us to do. There is a "spread" of 12 db at the bass end, while the treble peaks occur anywhere between 4 and 10 Kc and with heights varying from below reference to plus 10 db (or more).

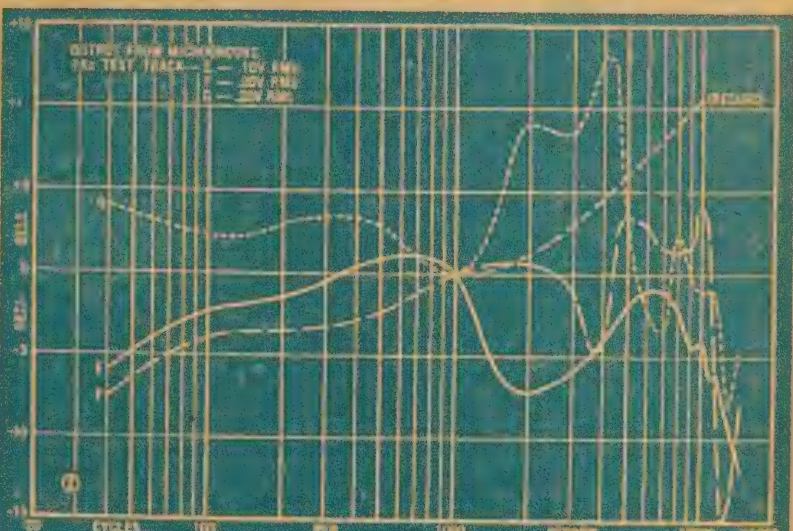
In general, all one can hope to do, as per the last issue, is to achieve the best overall balance between bass and treble and leave the individual troughs and peaks to look after themselves.

It all emphasises the point we have made before about pickups and recording characteristics. Unless one can start off with a pickup which is relatively free from such peaks and

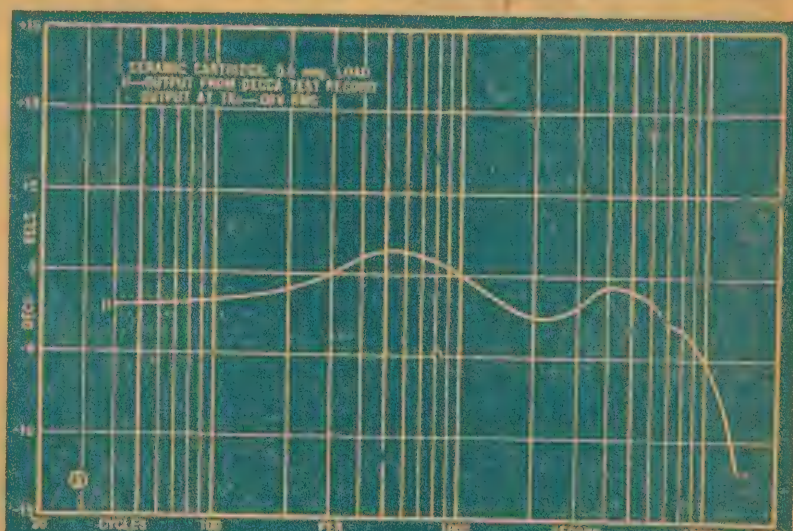
INTERESTING PICK-UP CURVES



Despite their similarity, these four curves are for different crystal pickups.



Three more pickups. Though quite different, they show the same tendencies.



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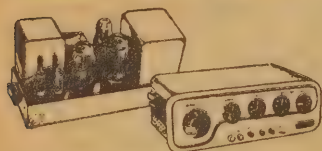


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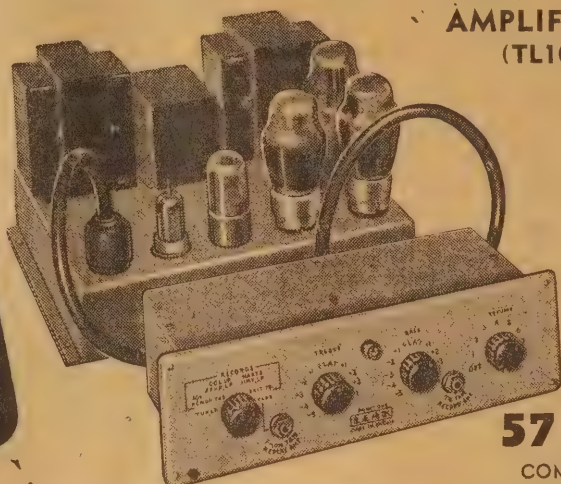


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troughs it is clearly futile to worry overmuch about exact compensation requirements.

There is a lot to be said in favor of adjusting the controls till things sound the best.

As a final point, it would seem that manufacturers are now designing crystal pickups so that, when playing a microgroove record and operating into a high impedance load, the output does not require any major correction. In other words, the rising bass response and tapering treble, roughly offsets the reverse characteristics in the record.

As we said last month, this property, combined with a relatively high output voltage, makes the crystal pickup a natural partner for all simple amplifiers and audio systems.

DOWN ON 78

It does mean, however, that when these same pickups are used to play conventional 78 rpm discs, having no treble pre-emphasis, the top response will be down by a good many decibels. To which, I should imagine, an appropriate retort would be "so what?"

Incidentally, I must confess to an apparent error in last month's article on crystal pickups. Something must have gone awry with one of the readings because the highest output I could read from a 1 Kc microgroove test track was just under 0.3 volt, which would represent a peak signal voltage of about 3.

Allowing for the odd pickup having higher output again and for 78 rpm records, one could expect a peak output of about 5 volts but scarcely 10. Either way, of course, it's plenty to overload a preamplifier grid.

By way of interest, we show in figure 3, the curve which we took of a ceramic type pickup, imported recently from overseas. Like the crystal, it produces an output proportional to displacement rather than velocity and produces a curve which, interestingly enough, follows the same basic pattern.

FLATTER CURVE

The troughs and peaks are of much lower magnitude, however, and this is all to the good. When playing anything but a Decca test record, the treble response would be lifted by a few db, although the bass would go down and ideally require some compensation or a higher output load.

However, curve 3 is interesting in that it may easily be a shadow of things to come. The ceramic pickup may well take over the "general-purpose" role of the crystal, do the job somewhat better and be less vulnerable to the effects of heat and humidity.

Time will tell.

Speaking of new things, I spent a couple of hours yesterday, fiddling with a magnetic amplifier which had recently been imported into the country.

It didn't take me all that time, however, to realise just how intimately one's ideas and conceptions have been wedded to radio valves and electrons.

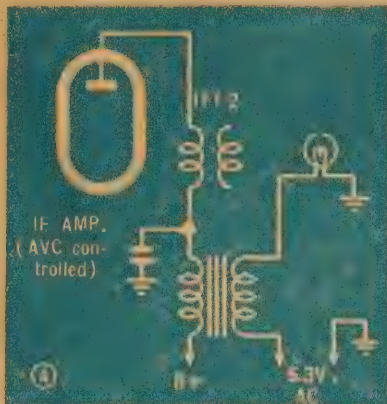
Faced with magnetic functions and terminology, the average radio technician displays about the same

order of facility as a man writing with the wrong hand.

The same is true, of course, when faced up, for the first time, with transistor theory. Bias, voltage, current and resistance all seem to be the wrong way round.

We tend to accept the valve and the electron as basic and fundamental, everything that deviates from this approach being non-standard.

It was some encouragement, however, to remember that I had used an elementary type of magnetic amplifier nearly twenty years ago. (I must be getting old.) Perhaps some of you will remember it, too.



An early form of magnetic amplifier. Remember it? It made possible those "tune by the light" devices in the middle thirties

It was a type of tuning indicator, in which the heater supply voltage was run through one winding of a small inductor to an ordinary dial lamp. Another winding on the same inductor carried the plate current of one or more AVC-controlled valves.

With the set tuned off a station, the plate current to these valves was high enough to saturate the iron core by reason of its DC magnetising effect. Under these conditions, the inductance of the secondary was at a minimum and very nearly the full heater voltage was applied to the lamp.

Tuning on to a station brought the AVC into action, reduced the current through the inductor, reduced the core saturation and allowed the inductance to rise. As a consequence, the lamp would dim almost to extinguishing point as a strong station was tuned in.

I forget all the details now but one might reasonably assume that the controlling signal would correspond to a change of about 7 milliamps through a winding of resistance, say, about 100 ohms. This would represent a power of .0049 watt.

On the lamp side, there might conceivably be a change of about 4 volts in the potential applied to the lamp, with a consequent change of about 0.2 amp in the current. This works out at 0.8 watt.

In other words, a "signal" of .0049 watt effects a change elsewhere in the circuit of 0.8 watt, representing a power gain of about 160 times.

The magnetic amplifier I referred

to earlier employs precisely the same principle.

50-cycle AC is applied to the power input terminals and passes through an inductor system to reach the power output terminals.

By applying a DC control voltage to a pair of "signal input" terminals, the power available from the output terminals can be varied from virtually nil to several watts. The AC output can be rectified, if need be, so that a small DC control signal can be made to produce a wide variation in AC or DC output power.

MANY REFINEMENTS

So much for the principle. Its execution, however, is as far removed from the simple little tuning indicator as the Williamson outfit is from De Forest's first amplifier.

In place of the tiny little core is a twin stack of thin, high-grade mu-metal. Instead of two simple windings, there are fourteen, all told.

Some of these are used in connection with an in-built "bias" circuit which, by means of a rectifier and potentiometer, allows enough DC to be circulated around the cores to bring them to the point of saturation. In this condition, a small change in external signal can effect a very big change in output power.

But even more intriguing is a feedback circuit which, by the use of auxiliary windings and a rectifier system, accentuates any change which might be effected by the signal circuit. In other words, it is a system of positive feedback and, according to the literature, can be carried to the point where the amplifier becomes unstable.

Have you ever thought of a magnetic amplifier oscillating? Ever tried to picture it?

For all that, the unit I refer to is described as a single-stage demonstration unit, with a presumably modest power gain of up to 40,000 times.

Not available at the time of writing are multi-stage and push-pull amplifiers, which are the ones you take seriously!

And how are magnetic amplifiers going to be used? At the moment, it seems that their major application will be to industry, where they will be used to amplify the output from all kinds of relay and metering devices.

At present, the output of such devices must either be monitored by an operator or applied, through a valve amplifier, to operate heavy-duty relays, &c.

But valve amplifiers have never been exactly famous for their reliability in such service and maintenance is always a problem. There are plenty of people who believe that magnetic amplifiers will solve it once and for all.

"But what of the transistor?" one might ask. "Isn't it supposed to overcome this problem also?"

Well, yes, it is.

Perhaps it's just a twist of fate that two very old ideas have been resurrected and developed to the point where they threaten the supremacy of the almighty "vacuum tube".

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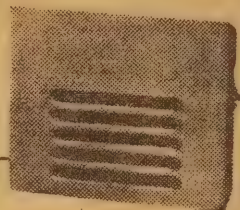
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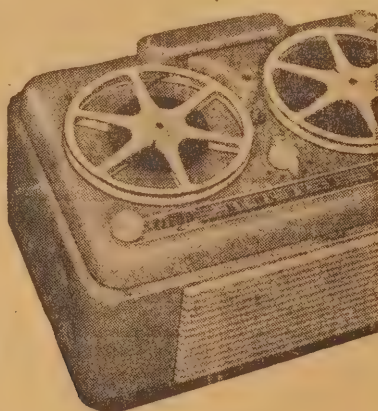
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An Amplifier for your Guitar

(Continued from Page 63)

biasing the filament supply to that stage. This is done in the Play-master amplifiers and could easily be done in this circuit by returning the centre tapped filament resistor to the cathode of the output valves rather than to the chassis.

A more serious source of hum is various magnetic fields produced by transformers &c. and which can couple with the magnetic pickup coil in the guitar. The most obvious source of such a field is the amplifier's own power transformer and it may be necessary to set a minimum distance between the amplifier and the guitar. If necessary the lead on the guitar should be lengthened.

FLUORESCENT LIGHTS

Another possible source of such hum fields is the ordinary fluorescent light, and is apparently due to the ballast choke normally employed in such devices. It is capable of introducing hum at a distance of several feet.

In wiring the feedback circuit it is important to realise that the connection to the speaker transformer voice coil winding must be correctly polarised. If not, the connection will provide positive instead of negative feedback and the amplifier will scream its head off.

The easiest way to determine which transformer lead should be earthed and which should go to the feedback system is simply trial and error. First get the amplifier working without feedback then temporarily connect the feedback. If the gain drops and there is no violent reaction, the connection is correct.

Once the unit has reached this stage there should be little more to do than give it a few simple checks, for such things as correct voltages, &c., then plug the guitar in and try it. In the ordinary way, the maximum volume available from the unit will be limited to that which it will deliver without overload, using the lowest string.

Once the correct setting for the main control has been found it may be left in this position and the control on the guitar (if fitted) used to vary the gain for special effects.

CARRYING CASE

The carrying case can be either purchased ready made to the published specifications, or constructed at home by anyone reasonably handy with tools. The dimensions shown in the diagram will be quite suitable provided the major components are similar in size to those used in the original. If there is any doubt about this it would be advisable to wait until the amplifier is completed. It can be assembled temporarily with the speaker to determine the space required.

The chassis is mounted in the cabinet by means of two 1-8in diameter bolts, three inches long, and which pass through the bottom of the case and two holes in the top of the chassis. Suitable flat washers and nuts complete the assembly. One of these holes is between the 12AX7 and 6BW6 sockets and the other near the speaker socket.

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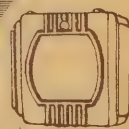
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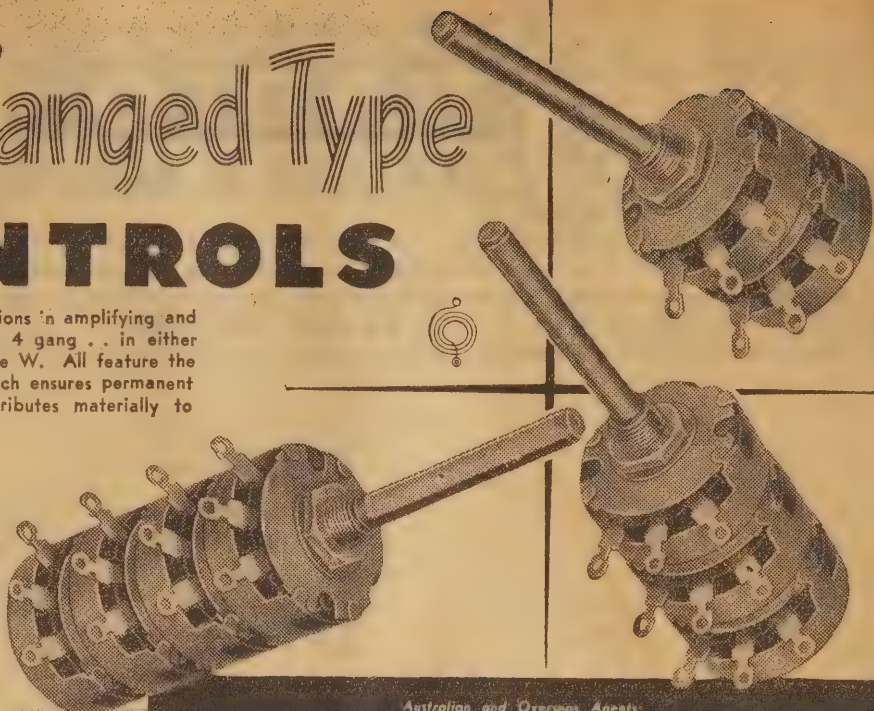
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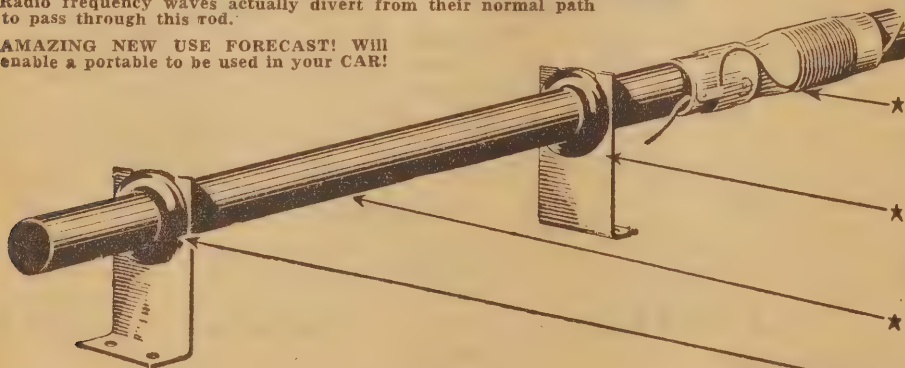
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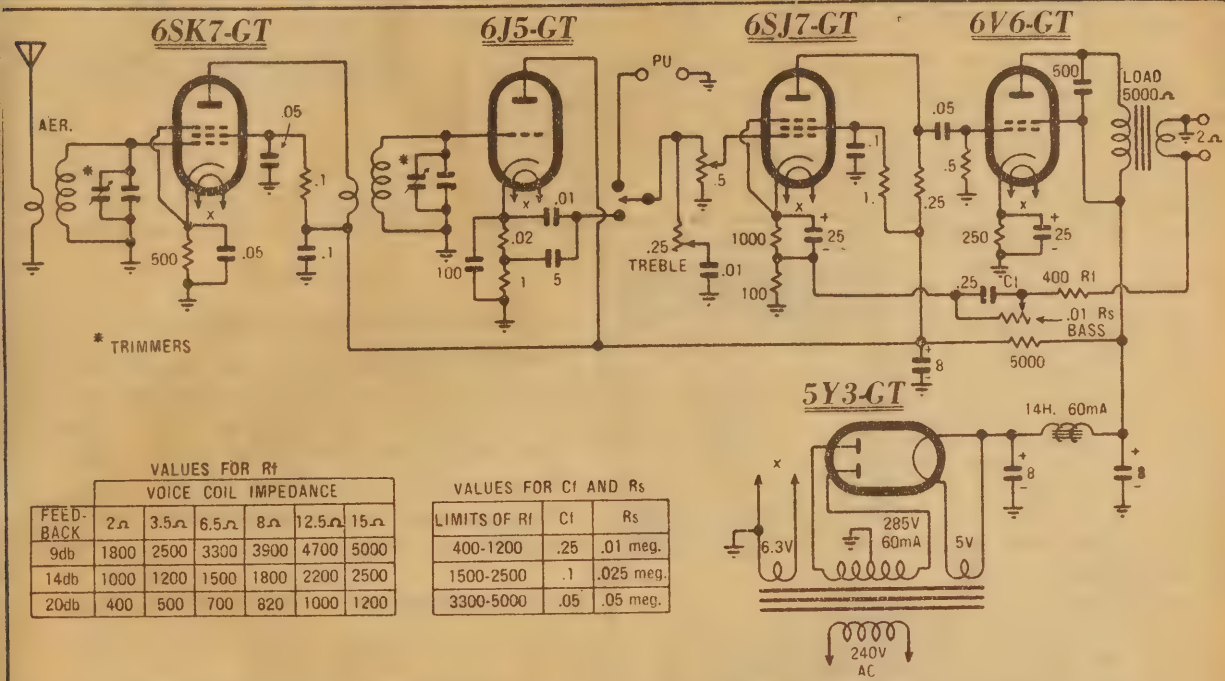
- ★ N.S.W.: WATKIN-WYNNE Pty. Ltd., 173 Pacific Highway, North Sydney.
- ★ QLD.: CHANDLERS Pty. Ltd., Cnr. Albert & Charlotte Sts., Brisbane.
- ★ S.A.: GEORGE PROCTER, 49 Pirie St., Adelaide.
- ★ W.A.: A. J. WYLE Pty. Ltd., 1011 Hay St., Perth.



A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

TRF GIVES IMPROVED LOCAL STATION QUALITY



The lower degree of selectivity of a TRF set as compared with the standard superhet is all to the good when reasonable quality of reproduction is desired from the local stations. Here is a simple, though suitable, design from a Queensland reader.

OUR contributor is Mr. H. Swan, of Bulimba Hostel, Brisbane St., Bulimba, Brisbane, Qld.

Superhet receivers are well known for their high gain and selectivity—the properties which have made them so very popular with the majority of listeners.

Unfortunately, the high selectivity is only achieved at the cost of treble response, the reproduction losing a good deal of its natural brightness.

The urge to hear as much as possible of the audio frequencies transmitted by local stations, particularly on live-artist programs, has led some listeners back to the TRF with its wider passband.

Although a more successful way of achieving good quality is to use the superhet principle with band-pass aerial circuit and modified IF channel (as popularised by Radio and Hobbies in, and from, the August, 1952, issue), the TRF can do a good job.

In this circuit diagram, the first two stages constitute the tuning portion, with the two other stages providing the audio amplification which can also be used for a crystal pick-

up or other high-output types.

Our contributor writes—"with 30ft of aerial around the room and a reasonably good earth, I can receive all local stations with plenty of power to spare, while in daylight, 4IP, Ipswich (about 25 miles away) is received quite comfortably."

Only two tuned circuits are used. For increased passband, these could be shunted with, say, a .05 megohm resistor, provided you do not lose too much gain. The feasibility of this will depend upon the signal strength of the stations at your location, although some compensation can be made by using a high-Gm valve in lieu of the 6SK7GT.

Such valves as 6AC7, 6SH7, EF50, &c., would suit, provided that signal strength was not so high as to cause cross modulation due to the sharp cut-off characteristic of these valves. Naturally, a change in valve type would necessitate a change in the value of the cathode and screen resistors.

The set will have five controls—tuning, volume, bass, treble, pickup switch. The pickup switch could

be mounted at the rear of the chassis or on the turntable motor board.

A simple arrangement, though not as convenient as a switch, is to take the output from the detector to a terminal which is bridged over to an adjacent terminal which connects to the "top" of the volume control. For pickup use, the bridge is removed and the pickup connected between the volume control terminal and an adjacent earth terminal.

The treble control is a simple top-cut circuit connected across the volume control. The control is less effective on radio program due to the shunting by the low impedance output of the detector. A much larger value of capacitor would improve matters for radio but would be too severe on pickup.

An alternative method is to replace the .5 megohm grid resistor of the 6V6GT with a .5 megohm potentiometer, taking the moving arm to chassis through a capacitor. Due to the effect of the audio feedback loop, the value of this capacitor would need to be around .02 mfd or higher.

The bass control operates in the voice coil feedback loop and for various degrees of feedback and voice coil impedances, the calculated values of these components

(Continued on page 89)

What Better Gift...

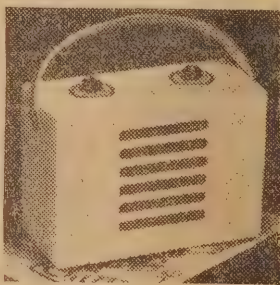
What better gift for a friend, or Mum, or any member of the family for that matter, than a radio, a design which you can choose specially for the person and the occasion, a set which you can build yourself at far less cost than similar commercial sets.

When you build it yourself, you not only save money but you give yourself hours of instructive enjoyment, and there's great pride and prestige to be derived from knowing that you built it yourself.

Electronic Parts Pty. Ltd., the kit-set specialists can supply you with a kit to suit your purpose and your pocket. Circuits are as designed by "Radio & Hobbies", and each kit is complete in every detail, including circuit building diagrams and highest grade components.

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There's no set could give greater pleasure to every member of the family, including yourself, than one which is designed for outdoor use. The Electronic Parts range includes a portable to suit every possible purpose. Among them are Carry Set, Jubilee, Rambler, Senior, Springtime and the new "R & H" Lightweight 4 or 5 valve portable. Two car radios are also available.



FOR HOME USE!

In those sets specially designed for home use, Electronic Parts have a tremendous range of nearly 100 sets. From the small 1-valve experimenter's type of receiver, we proceed through to the 2 and 3 valve bedside sets, to the full-size mantel and table models. There are numerous AC type receivers for your choice, including both small and super-de-luxe radiograms. The countryman is amply catered for in battery-operated, vibrator-operated, and 32 volt receivers.



TABLEGRAM.

PORTABLE GEIGER COUNTER!

If you have the urge to go prospecting for radio-active minerals, here's a compact, lightweight unit you can build yourself for remarkably little cost.



You might be lucky enough to strike it rich during the holidays. This mighty little unit could be responsible for making YOUR fortune.

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This range includes seven AC amplifiers, two vibrator-powered amplifiers, six tuners, and six control units. In addition, we have tape recorders and adaptor units, plus all the accessories the fidelity enthusiasts might desire. In our Kit-Set catalogue, which is free, we quote you for kits of parts and completely built Playmaster units.

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Perhaps the key man in the whole business is the technician and hobbyist. The requirements of the technical minded are amply covered by kits or complete test instruments, high quality public address and general purpose amplifiers, communications type receivers, inter-com units, battery chargers, complete range of "R & H" test equipment etc., etc.

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KIT-SET SPECIALISTS

TRADE REVIEWS AND RELEASES



NOVEL CRYSTAL SET FROM R. W. STEANE

Something new in crystal sets is represented by this neat little plastic cabinet manufactured by R. W. Steane, and containing an unusual method of tuning for such a receiver.

THE crystal set was the first type of radio set made, and has persisted to the present day as a popular starting point for hundreds of enthusiasts.

But it is no longer necessary to fiddle with critical catswhiskers and lumps of galena. The modern germanium-type sealed detector has changed all that, and today's crystal set is as stable as any other type.

The Q-plus receiver uses an extremely simple type of tuning, in which an iron dust slug is moved in or out of the coil former by the movement of the tuning dial. No

amount of juvenile fiddling is likely to put it out of adjustment, short of violent assault!

The set has two sockets on the front panel for headphones, and connections at the rear for an earth and two sizes of aerial. It measures only 5 x 3 x 2½ inches.

On test it gave a good performance on local stations and compared favorably with more elaborate designs. With Christmas coming near and price of about 50/- R. W. Steane should be ready for some brisk sales. Full instructions on each box.

TRADE NOTES IN BRIEF...

● MESSRS. Wm. J. McLellan and Co. Pty. Ltd. have released a modified switch-pot. combination, especially intended for use in portable receivers with reactivation. When turned into the extreme anticlockwise position, one section of the DPDT switch is open and the other closed. Turning the arm clockwise operates the switch mechanism, closing the open contacts and opening the ones that were previously closed. Price is the same as for the conventional unit.

● From AWA we received for test one of their "Jericho" power megaphones, as mentioned some months ago in these columns. Used like an ordinary acoustic megaphone, the unit contains a microphone, speaker unit and four torch batteries to power them. There are no valves and no external connections. All-up

weight is quoted as 7½lb and the price £37/7/1. The power megaphone is capable of projecting speech clear over several hundred yards and is finding a ready application among sporting and yachting bodies, on parade grounds, for naval applications and so on.

● The Technical Book and Magazine Co. (of 295 Swanston St., Melbourne, C1) has in stock sets of panel signs and transfers produced by "DATA" Publications Ltd., London. Two packages are available, one containing scales and terms normally used in receivers and amplifiers, the other for use with test instruments. The transfers can be applied to smooth or "crackle" surfaces, and, if need be, coated for permanency with a fixing varnish. They should be an excellent proposition for home constructors.

MODIFIED MODEL 2A FERROGRAPH

Below we give specifications of the modified Ferrograph magnetic tape recorder model 2A which has been brought to CCIR specifications as required by the BBC in England.

TAPE Recorders Pty. Ltd. of 183 Pitt St., Sydney, who handle the recorder in Australia, advise that they can now supply the modified Ferrograph from stock, in addition to the Standard 2A model for use by broadcasting stations and others interested in wide range recording.

Main additional features of the modified recorder are that the response is extended to 15 Kc and that 1750ft spools may be used, in addition to dual impedance inputs.

Here are some condensed specifications on the instrument.

Power consumption at 200-250 volts is 110 watts. Overall dimensions are 18½ x 17½ x 9½ inches with lid, weight 49½lb.

Standard ¼-inch tapes are used on reels up to 1750ft coating inside. There are two tracks, and operating speeds are 15 and 7 inches per second.

Playing time with large reels is 22 minutes at 15 inches and 45 minutes at 7½ inches. Total playing time—2 tracks—is 45 and 90 minutes respectively.

Rewind time is less than 1 minute for full reel.

Frequency response at 15 inches is 50-15,000 cycles plus or minus 3 db.

Wow and flutter are less than .2 pc at 7½ inches, longterm speed stability for 50 cycles is better than .5 pc.

Erase and bias frequencies are 53 Kc.

Input sensitivity on first channel is .003 volts peak, and on second channel .07 volts peak. Input impedances are high impedance and 600 ohm lines.

Power output is 2½ watts into 15 ohms with an inbuilt elliptical speaker. Signal to noise ratio is better than 50 db from 200 cycles to 12 Kc.

LATEST AEGIS COILS

AEGIS Manufacturing Co. Pty. Ltd. of 208 Little Lonsdale St., Melbourne, has introduced a completely re-designed range of miniature IF transformers and tuning coils.

By careful selection of materials and better production technique Aegis claim they have made coils which will outperform any other make regardless of price.

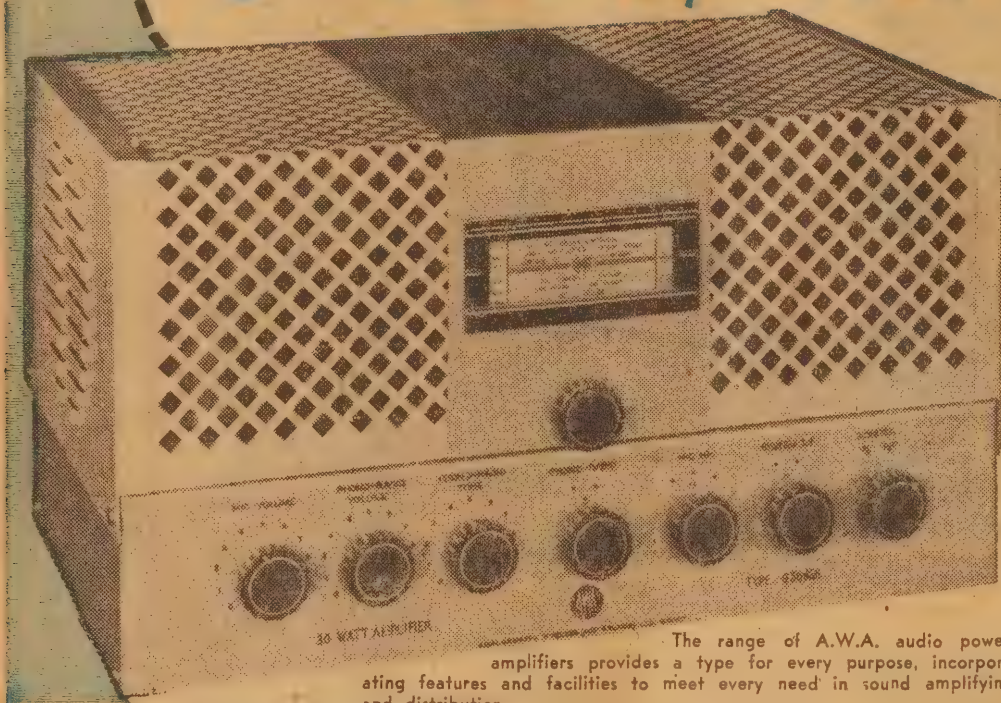
In support of this claim they have produced figures as a guide to users of their coils, quoting figure of Q, stage gain and sensitivity for various frequencies and various uses.

Details may be obtained from any Aegis distributor, or from the Aegis company in Melbourne.



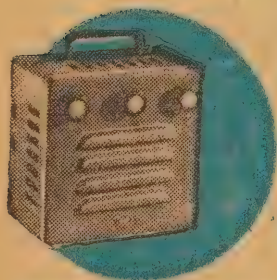
PUBLIC ADDRESS AMPLIFIERS

5 Watt to 70 watt



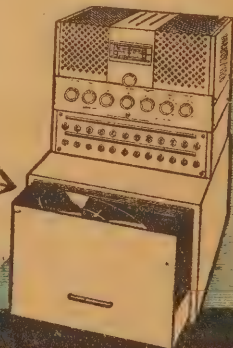
The range of A.W.A. audio power amplifiers provides a type for every purpose, incorporating features and facilities to meet every need in sound amplifying and distribution.

Designed and built to the same high standards of quality workmanship and performance for which the Company has established a world-wide reputation in broadcasting and communication equipment, models PA825 15 watt, PA826 30 watt and PA827 70 watt are illustrated above with radio tuner PA831 fitted. The amplifier protective cover has provision for mounting a monitor speaker.



5 watt portable amplifier type PA806 provides ample power for the needs of most indoor gatherings and many outdoor applications.

Radio, record playing, and speaker switching units assembled with the amplifier to form a centralised system.



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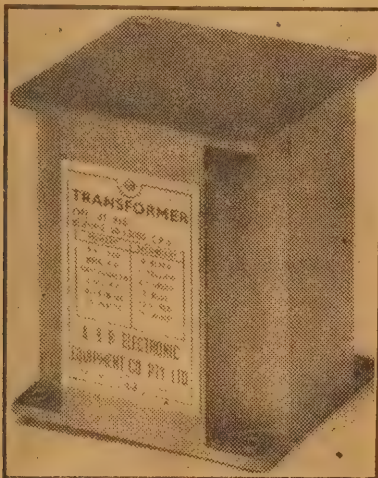
NEWTON McLAREN LTD., ADELAIDE. NOYES BROS. (MELBOURNE) LTD., HOBART. CHANDLERS PTY. LTD., BRISBANE. NICHOLSONS LTD., PERTH. ALSO FROM LEADING WHOLESALERS.

NEW TRANSFORMER FROM A. & R.

A new series of audio frequency transformers is announced by A. & R. Electronic Equipment Co. Pty. Ltd., of 378 St. Kilda Rd., Melbourne, a firm well known for high-grade products particularly in its home State.

THE first of the series to be in production include a range of output, driver and modulation transformers which have been improved and redesigned.

The audio transformers are listed



Typical of A & R finish is this OT918 .15 watt multi-impedance output transformer.

in three groups, known as medium, high and special high fidelity.

The medium group has a frequency specification of 50-12,000 cycles plus or minus 2 db. The high fidelity group is given as 30-15,000 cycles plus or minus 1 db, and the special high fidelity 20-40,000 cycles plus or minus 1 db.

In the special group there is a new design, the OT916 developed for use with 6V6-type valves or their equivalents in an ultra-linear circuit which is rapidly gaining in favor for high grade amplifiers. Wide range and good power handling are claimed for this transformer by the manufacturers, who have prepared a leaflet showing the circuit details and component values for its use in a typical circuit.

All these transformers are cased as shown in the accompanying photograph in a distinctive, silver-grey hammertone finish. They are available in a variety of output impedances, either to suit speaker voice coil circuits or in standard line impedances. Special types can be supplied to order.

Driver transformer type 588 is intended for driving 807's as class B triodes with a frequency range of 200-7000 cycles to cover speech frequencies, and has a primary for use

either in a singled-ended or push-pull circuit.

Type 545 is a Class AB2 transformer for use with a 6V6 triode connected driver with a 50-10,000 ohms response.

Modulation transformer MT15/75 is a 75-watt transformer with numerous tapings for speech work, bitumen filled and with built-in spark gap.

Sydney distributors, Homecrafts and URD, have now been appointed for A. and R. products.



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TYPE 44

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Hand or desk mounting, counter balanced base, ivory plastic housing.

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Built to a standard not a price !

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VSR.7 is
Australia's most
compact, reliable
Radio Telephone!

The Vaughan VSR.7 has already won high praise for its outstanding performance in these fields: Flying Doctor Services, Bushfire Warning, Professional fishing boats, Flood Relief, and many others.

The VSR.7 is extremely compact, measuring only 10in x 7 1/2in x 6in and features an in-built speaker, interchangeable frequency boxes, and easily replaced standard parts and valves. The crystal is locked on Transmit and receive. It operates from 6/12 volt DC or 220/250 volts AC with an output of 8/9 watts. It maintains the very high standard of workmanship and finish to be expected of equipment bearing the Vaughan nameplate.

For full information about this remarkable unit, write, phone or call:

EDWARD G. VAUGHAN PTY. LTD.

261-263 Pacific Highway, North Sydney, Phone XA1058-9.

DISTRIBUTORS: GEORGE'S BAY FISHERIES, St. Helens, Tasmania.
WEST DISTRIBUTORS PTY. LTD., 92A Barrack Street, Perth, W.A.
JOHN MARTIN PTY. LTD., 93 York Street, Sydney, NSW, Phone BX5061.
WHEELER'S RADIO SERVICE LTD., 194 Hutt Street, Adelaide, S.A.
PROFESSIONAL FISHERMANS' LEAGUE, South Brisbane, P.O., Box 41.

Radio and Hobbies, December, 1954



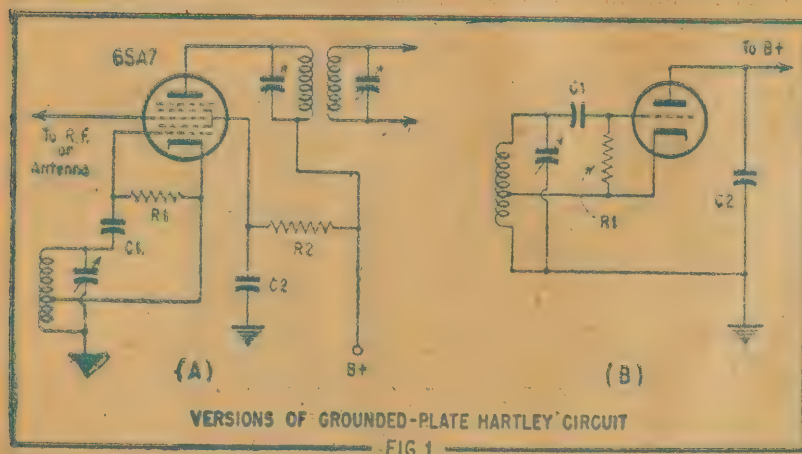
TWO TYPES TO CHOOSE FROM

The VSR.7p is available in a well finished, compact carrying case especially suitable for mobile operation.



OSCILLATORS IN A-M RECEIVERS

The performance of a superhet receiver depends a great deal on the design and operation of the oscillator. This article discusses typical oscillator circuits, as used in receivers covering the spectrum below 30 Megacycles.



A GREAT majority of the local oscillators in AM receivers are part of converter-tube circuits. In short-wave communications receivers, separate-tube arrangements are frequently encountered, especially when the coverage extends to frequencies of 30 Mc or higher.

The most popular oscillator circuit in AM receivers is the Hartley, although it does not usually appear in its basic form. Quite frequently the grounded-plate version is found.

PENTAGRID OSCILLATOR

A typical pentagrid converter oscillator circuit is shown in Fig. 1 (A). The basic triode grounded-plate Hartley is shown at (B) for comparison. In valves like the 6SA7 and 6BE6, grids 2 and 4 take the place of the triode plate.

The circuit variation of Fig. 2 has been used in small low-priced AM receivers. An additional winding L1 is interwound with L2. L1 is

called a "bifilar" winding. One end is left open. The capacitance between L1 and L2 takes the place of the capacitor C1 in Fig. 1.

Two examples of the use of inductance feedback in AM receivers are shown in Fig. 3 and 4 respectively.

The circuit of Fig. 3 employs the pentagrid converter version of the "tuned grid feedback" type. The same type of circuit is used with triode-hexode and similar frequency changers, which have a separate triode plate.

Figure 4 shows a cathode-coupled feedback arrangement. The latter can be pictured as the circuit of Fig. 3 with the plate feedback coil moved through the plate power supply and into the cathode circuit.

DUAL TRIODE

A typical dual triode oscillator-mixer circuit is shown in Fig. 5. This arrangement is popular in TV and communications receivers where

low noise level and minimum oscillator/RF interaction are required.

Sometimes a small capacitor connected between grid or cathode of the oscillator and mixer grid is used for injecting oscillator voltage to the mixer. In other cases, the cathodes of the mixer and oscillator are either common or coupled together.

The following are important requirements in the design of oscillators in low-frequency AM receivers:

1. Ease of oscillation.
2. Freedom from undesired resonances.
3. Constant output amplitude.
4. Frequency stability.
5. Minimum of harmonic output.
6. Tracking.

Conditions for oscillation must be well fulfilled, so there is no tendency toward delay or failure in starting or maintaining oscillation.

EASY OSCILLATORS

Oscillation criteria show that from a general theoretical standpoint, the tuned grid feedback and Hartley are the easiest oscillators. The Colpitts circuit also oscillates easily, but is seldom used in receivers because of the added components required—(capacitors in the tank circuit).

If the basic design does not allow easy oscillation, then excessive plate and/or grid currents may be necessary, with resulting overheating and instability, as well as excessive power requirement.

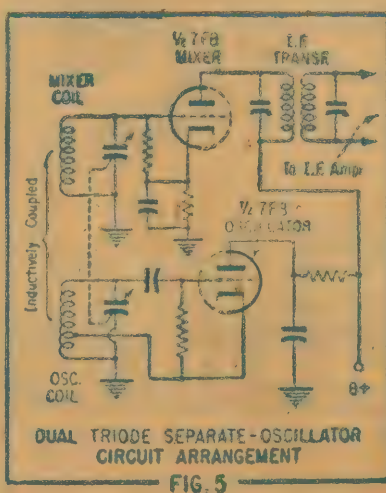
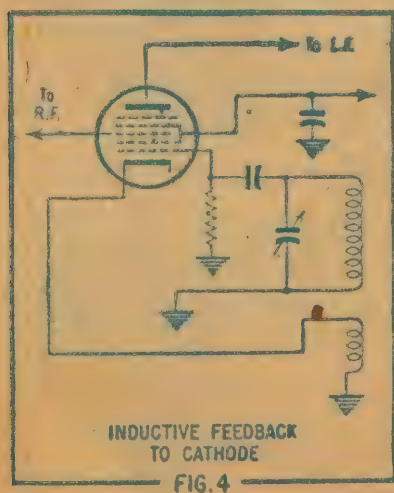
Undesired resonances are most likely to occur in the inductive feedback type of circuits (tuned grid and tuned plate types). In these circuits the feedback or "tickler" coil may resonate with its distributed capacitance or with stray circuit capacitance.

If the resonant frequency is within the tuning range, sufficient power may be absorbed to stop oscillation at and around that frequency. At the very least, operation in the vicinity of the frequency of undesired resonance becomes unstable and undependable.

If the receiver is of the multi-range type, the coil of one range which is unused may self-resonate within the tuning range of the coil in use, with results similar to those mentioned above. The unwanted frequencies of resonance and their effects are often referred to as "dead spots" and "suckouts".

RESONANCES

Undesired resonances can, to an appreciable extent, be avoided by careful initial design. However, all possible resonances naturally cannot be anticipated, so a breadboard test for suck-outs is a sensible precaution.



The best test is observation of the value of rectified grid current as the oscillator is tuned through its range. The rectified current of the mixer injection grid is also a good indicator if separate oscillator and mixer tubes are used. Any tendency toward unwanted resonances will show up as sharp variations of this grid current as the resonant frequencies are approached.

Such conditions can also be traced with a grid-dip oscillator, but it must be remembered that such an analysis is not complete unless the tuning capacitor of the grid-dip oscillator is varied through its complete range. Sometimes the tuning capacitor is part of the unshielded resonant circuit.

No general formula for eliminating unwanted resonances can be given; it's just a matter of changing the circuit constants so that these resonances are moved outside the tuning range, or better, if at all possible, eliminated altogether.

USE OF SWITCH

In multi-range receivers in which the coils of different ranges interfere with each other, the resonant frequency can be moved out of the range by adding a section of the switch which shorts each unused coil. On some ranges it may be better to leave the coil open when unused.

In any event, a large percentage of troubles can be avoided by careful initial study of the inductances and capacitances involved, and the checking of each coil in respect to self-resonance and its mutual inductance with other coils after installation in the circuit.

The amplitude of oscillator injection voltage has an important effect on the operation of a superheterodyne receiver.

If the amplitude is excessive, sharp discontinuities in the conversion characteristic occur and excessive oscillator harmonics are produced. These harmonics lead to many spurious responses, manifested by whistles and "birdies" in reception.

On the other hand, if the injection voltage is too low, conversion transconductance falls off sharply and receiver sensitivity is limited.

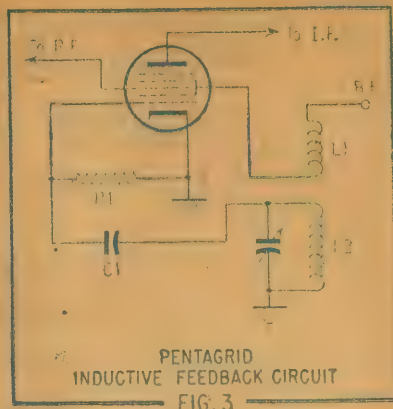
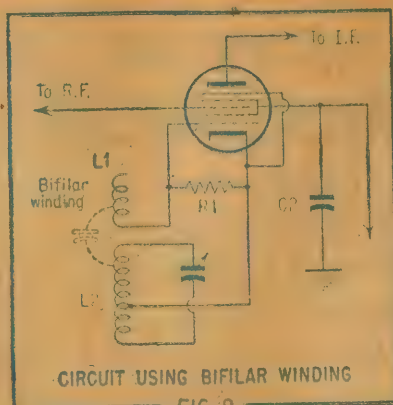
Thus it is important that the output amplitude of the oscillator remain substantially constant over the tuning range. Unless compensated, the output of a capacitance-tuned oscillator increases as it is tuned from the low to the high frequency end of its tuning range. To compensate for this, some method of reducing relative output toward the high frequency end should ideally be employed.

COMPENSATION

One convenient method employs the grid-cathode capacitance of the tube, with an added resistor to form a voltage divider as shown in Fig. 6. Since the grid-cathode capacitance portion of the divider is a lower impedance at the higher frequencies, less voltage is applied to the grid from the tuned circuit.

Typical effect of compensation is illustrated in Fig. 7.

The circuit of Fig. 6 also compensates amplitude by its loading effect on the grid coil. The resis-



tor and capacitor in series damp the coil with a shunt resistance which decreases with frequency, thus compensating for the normal oscillator amplitude increase.

The effective shunting resistance is the reciprocal of the real part of the admittance of the two components in series, which can be derived as

$$R_{eff} = \frac{1 + \omega^2 C_{gk}^2 R^2}{\omega^2 C_{gk}^2 R^2}$$

For example, if the tube has a grid-cathode capacitance of 10 uuf, a 1000-ohm resistor produces the following loading effect when connected in series with it:

at 550 kc	840,000 ohms
1000 kc	253,000 ohms
1600 kc	112,500 ohms
5 mc	10,100 ohms
10 mc	2525 ohms

Obviously, the value chosen for the compensating element R depends upon the loaded effective Q of the circuit, as well as the degree of original amplitude variation to be compensated.

Other methods for amplitude stabilisation have been employed but, in most AM receivers, cost limitations prevent use of any elaborate arrangements.

Often the constancy of injection voltage is compromised somewhat so as to vary from the minimum allowable for sensitivity at the low frequency end to maximum which will sensibly limit spurious response at the high end.

Since the frequency of the IF signal, and thus proper reception depends upon the frequency of the oscillator signal, frequency stability is very important. Its importance increases as receiver selectivity relative to received signal bandwidth increases.

For example, suppose an AM broadcast station transmitting audio modulation up to 12 Kc is

to be received. If the receiver has a pass band of just 24 kc, any drift in the local oscillator causes attenuation in the receiver of some of the high frequency modulation signal components.

But suppose the same receiver is employed for a communications signal in which modulation frequencies are limited to a maximum of 3 kc, or a bandwidth of 6 kc. If this signal is originally tuned exactly in the centre of the 12-kc receiver pass band, the oscillator can drift 3 kc either way without sideband clipping.

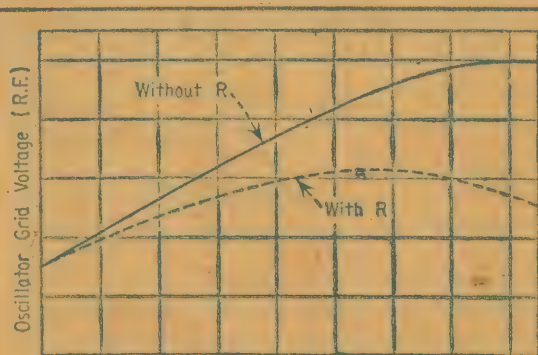
Oscillator drift is thus not as annoying if extra pass band is available at the receiver. However, in practical design, such extra response width is not ordinarily feasible (1) because of resulting increased noise and (2) because of adjacent channel interference effects.

Accordingly, appreciable attention must always be given to frequency stability. There are many factors involved in stability and a great deal of work has been done with it, particularly in connection with transmitters.

DESIGN POINTS

Frequency instability may rise from one or more of the following causes:

1. Variation in tuned circuit resonant frequency due to changes in L or C resulting from changes in temperature or humidity.



EFFECT OF AMPLITUDE-COMPENSATION BY MEANS OF SERIES GRID RESISTANCE

FIG. 7

"ACOS" CRYSTAL MICROPHONES AND MICROPHONE INSERTS

The Finest Range Available in Australia for:—

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PUBLIC ADDRESS
HEARING AIDS
BROADCASTING STATIONS
AMATEUR RADIO**



MODEL 35
(HAND/DESK)

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(HAND/DESK)

PRICE £9/18/6



MODEL 16
(HAND/FLOOR)

PRICE £26/19/6

TECHNICAL DATA SHEETS GLADLY FORWARDED ON REQUEST

"ACOS" CRYSTAL MICROPHONE INSERTS

MIC. 3 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.3-2	General Purpose	1 7/16 in dia. x 3/4 in thick	20db Peak at 2500 C.P.S.	Mona	£1 19 3
MIC.3-5	" "	" " " " "	12db " " " "	Mervyn	1 19 3
MIC.3-6	" "	" " " " "	5db " " " "	Myrtle	1 19 3

MIC. 6 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.6-4	General Purpose	2 1-3/16 in dia. x 19-3/16 thick	20db Peak at 2250 C.P.S.	Margie	£1 19 3
MIC.6-6	" "	" " " " "	5db " " " "	Maudie	1 19 3
MIC.6-11	" "	" " " " "	12db " " " "	Mandy	1 19 3

MIC. 14 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.14-5	General Purpose	1 7-16 dia. x 1 1-3/16 in thick	20db Peak at 3500 C.P.S.	Maxie	£1 19 6
MIC.14-11	" "	" " " " "	12db " " " "	Mitchell	1 19 6
MIC.14-12	" "	" " " " "	5db " " " "	Malcolm	1 19 6
MIC.15	Hearing Aid	0.9in dia. x 0.155in thick	30db " " 3000 "	Marlene	1 19 6
MIC.17	" "	15-16in sq. x 7-3/16 in thick	30db " " 3500 "	Maggie	1 19 6
MIC.18	General Purpose	1 7-16 in dia. x 9-3/16 in thick	20db " " " "	Maisie	1 19 6
MIC.19-4	" "	1 3/4 in dia x 13-3/16 in thick	Flat from 40 to 6000 CPS	Merry	1 19 6

MIC. 23 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
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2. Changes in interelectrode capacitance values in the tube.
3. Fluctuation of operating voltages.
4. Changes in the load offered by the mixer.

One instability effect important in connection with oscillators in AM receivers is known as "pulling". Efforts to align the RF tuned circuits of a receiver (or signal generator) signal result in a shift of oscillator frequency, detuning the receiver from the desired signal. This makes it difficult to obtain optimum alignment.

The interaction is due to (1) space charge coupling in the converter tube and (2) any direct coupling present between the oscillator and signal-grid coils or circuit.

ROCKING TECHNIQUE

If "pulling" cannot be completely eliminated in design, its effect can be minimised by the "rocking" method of alignment. Better still, if a noise source is available, alignment by noise output will be free of pulling effects.

Harmonic output from the local oscillator is undesirable because it can lead to a number of different interference effects. Chief among these is the beating of an oscillator harmonic against a higher frequency station from which the harmonic is separated by the intermediate frequency.

Harmonics also adversely affect stability of the fundamental.

A certain amount of harmonic output is inevitable for all RF oscillators, since non-linearity is essential to their operation. However, harmonics can be kept very low by careful attention to the following factors:

1. Use of a low L/C ratio. The selectivity of the tuned circuit is then much greater because of the high Q of the tuned circuit. Unfortunately, in capacitance-tuned oscillators, a low L/C ratio at the high frequency end of the tuning range is not consistent with full tuning range possible from a given tuning capacitor.

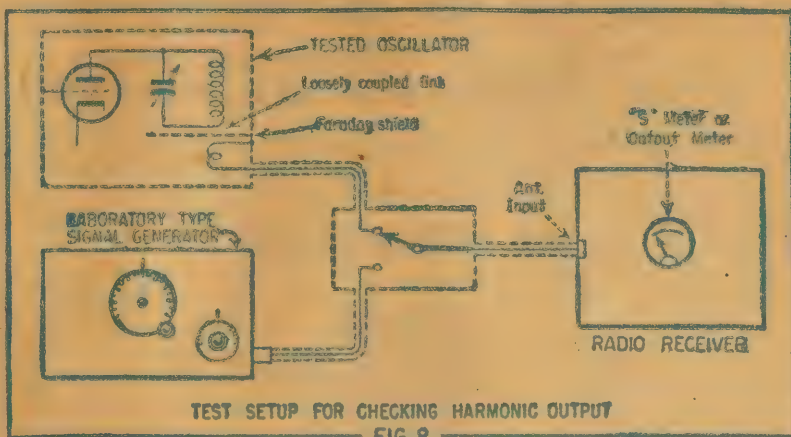
Ordinary tuning capacitors, when connected into an oscillator circuit, provide a maximum tuning ratio of about 3 to 1. This ratio is attained only at the expense of a relatively high L/C ratio at the high frequency end of the tuning range.

INDUCTANCE TUNING

This problem can be overcome by inductance tuning, but such tuning is not practical or desirable in many receiver applications. Thus if harmonic output is to be minimised in wide-range tuning, other harmonic-reduction measures must be considered.

2. Increased coil Q. Higher effective Q during operation can, of course, be obtained by increasing coil Q as much as possible. Use of Litz wire within its favorable frequency range, use of bank and other special windings and optimum dimensional relations are well known methods.

In the appropriate frequency ranges, addition of a powdered iron core can provide an appreciable increase in Q.



3. Limited power and drive. In most AM receivers, injection power requirements of the mixer are low enough to allow good operation with relatively low oscillator power output. Since harmonic content is greatly increased by use of large bias and drive voltage, it is desirable that feedback be reduced to a minimum necessary for easy oscillation. For lowest harmonic content with appreciable output, most oscillators should approach class B operation. The design procedure should be as follows:

- (a) With no limitation on feedback path, adjust operating conditions, including feedback ratio, for maximum grid current. This would include adjustment of the tap on Hartley coil, capacitors in Colpitts divider, etc. The objective of this step is to obtain optimum feedback phase relation.

- (b) Reduce applied plate and/or screen voltage to minimum values necessary for easy oscillation, also.

- (c) Simultaneously decouple the resonant circuit to minimise grid current for desired output. Greatest reduction of feedback amplitude with maintenance of optimum feedback phase should be the objective.

If the frequency range of the oscillator is such that a suitable sensitive radio receiver covering the fundamental and several harmonic frequencies are available, the method of Fig. 8 can be used for testing harmonic output.

The signal generator should be of the laboratory type, with low leakage and dependable attenuator and output voltage readings. The coupling to the tested oscillator should be light and through a shielded link with as little capacitive coupling as possible.

The receiver must be well shielded, and should have a signal meter. If it does not have a signal meter, VTVM measurement of AVC or detector DC voltage output can be used.

The coaxial lead

should be terminated at the receiver with a composition resistor matching the characteristic impedance of the cable. The switch should be completely shielded in a box to which connections are made through coaxial connectors.

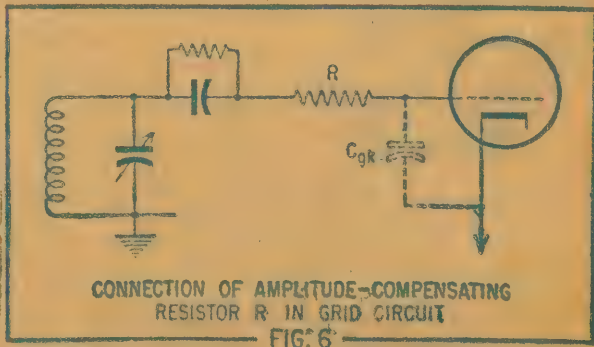
The receiver is first tuned to the fundamental frequency of the oscillator, which should be the highest frequency of its range (for worst harmonics). The signal generator is shut off. The receiver controls and the coupling to the oscillator are adjusted for convenient reference indication on the indicating meter.

SAME READING

Now switch S is thrown to the signal generator. The latter is turned on and the oscillator turned off. The signal generator attenuator is now adjusted for the same receiver output and its output voltage indication noted.

Next without touching the coupling to the oscillator, repeat the whole process, with the receiver tuned to the second harmonic of the oscillator frequency. The ratio of the signal generator voltages is the ratio of harmonic to fundamental. The same process should be repeated through at least the third, and preferably the fifth harmonic.

The final important requirement for the oscillator in low frequency AM receiver is tracking. Since tracking is so important, it is discussed by itself in a separate article. (By courtesy of the Aerovox Corporation.)



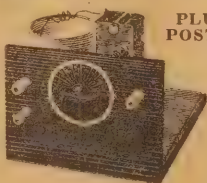
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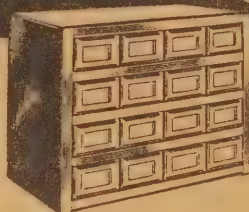
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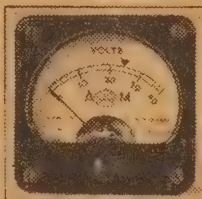
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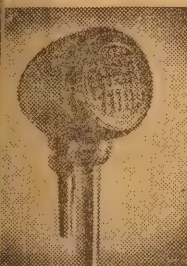
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FROM THE SERVICEMAN WHO TELLS

(Continued from Page 41)

as it used to when he first acquired it. I imagine that the experience also served to emphasise that there are many things which can go wrong with a set besides faulty resistors and condensers and that one has to be very lucky to pick a fault on this basis.

He also intimated that he intended to brush up on his soldering technique.

SORRY!

And finally I have an apology to make. Toward the end of last month's article I set out to tell the story of a butchered loud speaker. Unfortunately, somewhere between my typewriter and the final printing process, the tail end of the story went astray. The result must have been extremely frustrating to say the least.

Anyway, here is the rest of the story:

The story comes from a reader and, in turn, from a serviceman friend, but both are prepared to swear on a stack of Bibles that the facts are true.

The reader is Mr. J. M. H., of Narrabri, NSW, and the story is probably best told in his own words:

"The case was of a mantel set which has the speaker in the top facing upward. The set was owned by a hotel keeper and was left on the bar for the benefit of the customers.

SLOWLY DIED

"After a while, for some unknown reason, the output began to get weaker and weaker and eventually stopped altogether. The cause was a novel one. Apparently some misguided, beer-soaked individual had decided to become a teetotaler and had poured the contents of his glass into the nearest convenient receptacle which, in this case, happened to be the top of the radio set. The beer had remained in the cone and eventually soaked through to the voice coil and rusted in and blocked up the works.

All right, fellows, see if you can beat that one!

A READER BUILT IT!

(Continued from Page 79)

are listed in the tables on the circuit diagram.

The greater the feedback, the lower will be overall distortion and sensitivity, the limit being set either by the quality of the output transformer or the minimum sensitivity. For a given transformer, too much feedback will cause audio instability.

Note that a selected value for the resistor R_f taken from the first table according to the voice coil impedance and the amount of feedback desired, will fall in a range which will require a combination of values for both C_f and R_s obtainable from the second table.

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OFF THE RECORD — NEWS & REVIEWS

Today's standard of recording is so good that only rarely do I hear a disc which gives me a thrill by virtue of its superlative sound. When in Melbourne recently I came across such a record, good enough to give me a new idea of what bass response can be like in the home.

THE record was made by the American Cook Laboratories, a firm which specialises in high quality records for the connoisseur.

It was made in the Boston City Hall, where there is a fine organ, and the technicians had obviously spent much time in achieving balance and wide frequency range. According to the jacket it was the first time that a 16 cycle organ note has been successfully pressed on a disc.

I wasn't able to count fast enough to verify this fact, nor could I estimate what proportion of fundamental there was in the extremely low notes. I can only say that I would never have believed it possible that so much convincing weight could be reproduced in an ordinary room.

The speaker system used a 15-inch bass speaker of high quality mounted in a large sand-filled enclosure, and the top end was handled by an 8-inch speaker of wide range, the two connected through a crossover network. The pick-up was of a newly designed moving coil type and it handled the extremely heavy bass apparently without effort.

It is possible, of course, that there would be several variations in equipment which would have equalled the performance I heard. But to get such bass response on a disc available to the public, that was really something.

It is doubtful whether such a record would be of much use on the

By JOHN MOYLE

average radiogram, and possibly only a firm such as Cook could afford to produce it. But for those who can operate really high grade equipment it demonstrated that the possibilities of the disc record are far from being exhausted.

And now to list some records I have heard during the month.

GABRIEL FAURE. — String Quartet in E minor, Opus 121, played by the Guilet Quartet; Sonata No. 2 for violin and piano in E minor, Opus 108, played by Daniel Guilet, violin, and Gaby Casadesus, piano. Nixa QLP 4008.

Not many listeners to this record will be familiar with the music, for it is not often heard. I cannot bring to mind any recordings — certainly not recent ones — which have featured it.

But no one will fail to be struck by the way in which the performers have mastered the Faure idiom and the sensitivity with which they pursue it.

This is most remarkable in the quartet, and without such a mastery the music could easily degenerate into a meandering humiliation. Incidentally, this was his last work, written when he was quite deaf.

To play it after the more obvious formality of Mozart, for instance, is to experience some bewilderment in search of its musical structure. More immediately obvious are the serene, ethereal thoughts of a distinguished mind and the extreme beauty of the tonal weave which ebbs and flows in a constantly developing pattern of intimacy and color.

Faure is a most important composer musically and historically, and although Capitol's recent release of his famous Requiem may be more readily understandable, this new disc should find a place in any serious collection. Technically it is good — the best piece of chamber music I have yet heard from Nixa.

Only in the last section of each side was there a query in my mind about deterioration in quality and here the stylus might have been to blame. Instrumental quality is full and forward. Surface noise virtually absent except for a couple of revolutions at the commencement of the sonata.

If this is your kind of music I recommend this disc.

BEETHOVEN. — Symphony No. 3 in E flat Major, Opus 55. Played by the Concertgebouw Orchestra of Amsterdam conducted by Willem Mengelberg. Radiola-Telefunken LSK 7006.

If you are an admirer of Mengelberg as a conductor, and I am certainly one of these, you will need no persuasion that recordings such as this richly deserve to be preserved, despite the fact that they do not equal

the vividness and impact of today's best orchestral recordings.

I think I am right in saying that they are taken from earlier 78 versions. But the transformation is made with great skill so that it is only apparent to the keen observer with better than average equipment. He will note the surface noise changes, and here and there the extra clarity of a new side.

The dynamic range, too, is not as great as the best we can hear today, although it has, I imagine, been improved in the transcription process.

But in my opinion these things do not lessen the stature of the record judged purely as a performance. It is something of an education to note the musical sincerity of Mengelberg, the way he achieves the drama and force of the symphony without the prop of superlative sound which others have since had at their command with less distinction. To me, at any rate, this is Beethoven as he should be played.

The frequency range is surprisingly good and the balance of orchestral sound weighty and convincing. Had these records been made today they would have been outstanding. As it is, they are better than many LPs I have heard, which in itself is a tribute to their original excellence from a technical viewpoint.

The surface noise is naturally a little higher than normal, but it is no more than a quiet rustle, not particularly apparent except in quiet passages. The break in the second movement for turnover was probably difficult to avoid. I suggest the EMI or NAB playback curves.

BEETHOVEN. — Symphony No. 1 in C major, Opus 21; Symphony No. 8 in F major, Opus 93. Played by the Concertgebouw Orchestra of Amsterdam conducted by Willem Mengelberg. Radiola-Telefunken LSK 7013.

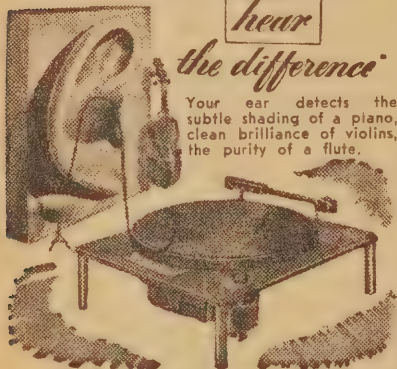
The same general remarks apply to this record as to the recording of the Eroica, although the general tonal effect is not quite as bright. On the other hand the surface noise is appreciably lower, although the general contrast with Carl Schuricht's disc reviewed last month is technically in favor of the latter.

Mengelberg's use of varied tempo as compared with Schuricht is most noticeable, particularly in No. 1, the first movement being an interesting example. But it is never misplaced or extreme, and it is not the least important reason why his Beethoven always sounds with interest and vitality.

It's a pity that there is a strange moment in the third movement where something appears to have gone wrong with the quality.

The recording of the 8th is much the better side from every viewpoint and, if anything, is better than the Eroica. It is Mengelberg at his best — a beautiful performance.

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VAUGHAN - WILLIAMS. — English Folk Song Suite, Fantasia on Greensleeves, Norfolk Rhapsody, Fantasia on a Theme by Thomas Tallis. Played by the Philharmonic Promenade Orchestra conducted by Sir Adrian Boult. Nixa NKP 905.

This new Nixa comes within striking distance of their two late successes and is obviously recorded with the same general technique. Musically it should have a very wide appeal, for it includes some of Vaughan-Williams' most popular and beautiful music played with firmness and grace.

Adrian Boult is a conductor who has been represented on records probably as long as any present-day conductor, and I often wonder why his sound musicianship has not received more credit.

The balance of the orchestra has plenty of "air" about it. It shows up with some solid bass and clear role although the sudden drama of new attacking string groups makes me think there is more than one microphone at work. Dynamics could possibly have been a little smoother, but perhaps Boult meant them that way.

The surface isn't quite as good as recording, being marred a little by some crackles and a slight swish in a couple of places which will show up on wide range machines. String music is on the sharp side, but played with a NAB setting can be satisfactorily tamed.

In brief—a very attractive disc all worth a hearing.

SCHUBERT.—Trio No. 2 in E flat major, Opus 100. Played by Alexander Schneider (violin), Pablo Casals (cello) and Mieczyslaw Horszowski (piano). Philips A01107L.

In this it is a little inferior to the Westminster disc issued some few months ago. But musically it is much more mature than the Westminster. Particularly in the Andante second movement the players see much more of the music and the more experienced musical listeners will undoubtedly respond to it.

Casals shows little of the years which have passed since the days of his prime. Only once or twice will you detect a slight lack in firmness, but then only if you know how to look for it. The ensemble is so good that we can only admire the ease with which the difficulties of a trio combination of this kind are absorbed by all three performers.

Technically the only flaw I think worth mentioning is the tendency for the sound to wash out here and there in very quiet passages, where we realise most that it is not a studio job. It plays quite cleanly throughout, and the surface noise at ordinary room volume is virtually inaudible.

HANDEL.—The Messiah. Sung by Margaret Ritchie (soprano), Constance Shacklock (contralto), William Herbert (tenor) and Richard Standen (bass) and the London Philharmonic Choir, with the London Symphony Orchestra conducted by Hermann Scherchen. Nixa HLP 907-1-3.

In a work of this size it would be uncharitable not to expect some points which can legitimately come in for criticism. The danger is that to mention them would be to discount much good work which might be overlooked.

There are plenty of passages which are quite magnificently done, and magnificently recorded. In general, the technical standard is high. Both the orchestra and the choir frequently shine brightly, equal to any of their competitors. In fact, I would say that many choruses are more effective than those in the fine Decca release mentioned recently.

The soloists are uneven, although all have their highlights. William Herbert's light lyric voice does not show to good advantage until the oratoria is well under way, and Constance Shacklock isn't always equal to the demand. Richard Standen I thought quite the best, and his singing most impressive.

All show the influence of Scherchen's musicianship, but his endeavor to build vitality into the music sets him racing at times with anything but good effect, as in the Hallelujah Chorus. The Pastoral, also, he takes at a strangely fast rate.

It is his brisk tempo which is largely responsible for the use of only three discs as against Decca's four, but that's not a bad thing for the purchaser's pocket!

But this is, nevertheless, a very good effort in many ways, and its standard is quite sufficiently high to ensure that it won't be overlooked. The recording is very clean and surface noise low.

JOHANN STRAUSS, JOSEF GUNG'L.—Selected music played by the Westminster Light Orchestra, conducted by Leslie Bridgewater. WL4004.

A particularly clean and well-balanced record of Viennese music which everyone likes. In case you haven't heard of Gung'l before, you will almost certainly recognise some of his music, which is written in the Strauss idiom.

A small orchestra like this one is a "sitter" for a recording studio such as Westminster's, and sure enough, they have achieved a splendid mixture of clarity, forward presentation, and just the right amount of reverberation to give spaciousness without losing that sense of intimacy.

Listeners to the BBC will know about Leslie Bridgewater and his skill with light music. His work here is first-class.

Surface noise with such a record would spoil everything. But even on an AES curve (and for once the jacket gives this advice) it can be completely ignored.

In brief — one for everybody, and earns 4.5 stars.

CHOPIN.—Twenty-four Preludes. Played by Freidrich Gulda on Decca LXTA 2837, and by Cor de Groot on Philips A 00109 L.

If I had to choose between these records on the performance, I would choose Gulda. For me, he has more of the authentic Chopin mind and manner, and shows a fine understanding of these beautiful preludes.

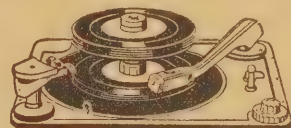
De Groot is more aloof—he is de Groot playing Chopin, rather than Chopin being played by de Groot. His is the smoother performance, but there are passages in Chopin which are far from being smooth in that sense. I should say the difference is temperamental, and if I think that Gulda is more authentic I don't mean de Groot cannot be enjoyed as well.

Judged on recording, however, I would choose de Groot, for, although the general piano quality just about balances, the Philips is a particularly clean, quiet record, whereas

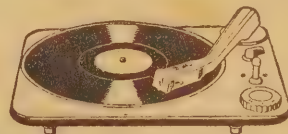


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the Decca is neither. In parts the quality is not good and the surface noisy. This is a pity for musically both records are decidedly worth while.

BRAHMS — Symphony No. 3 in F Major Opus 90, played by Vienna Philharmonic Orchestra, conducted by Karl Bohm. Decca LXTA 2843.

Although this is probably the best recording of the Third Symphony available at the present time, I personally find it somewhat unsatisfying. Maybe because it is a romantic interpretation, whereas in my view it sounds better with stronger, more dramatic treatment.

It seems, too, to be cast in rather a limited mould. There is a grand opportunity to balance the andante second movement and the poco allegretto of the third against the greater urgency of the first and fourth. As it is, they all sound as though they have been tailored to meet a similar pattern. The allegretto marking seems to have been overlooked altogether.

At the same time, it is a safe and generally acceptable performance, and will please many. But how I would have welcomed an extra bite to the string attack and a bit more "hurry" in the obvious places, instead of that remorselessly steady beat!

The recording is good, with some muddiness during moments of pressure. It played best on the NAB curve, which gave more body to the bass than the standard Decca.

The surface isn't silent, although what noise is present lies buried under the sound.

I'm sure it will be a popular record.

TCHAIKOWSKY — Symphony No. 4 in F Minor, Opus 36. Played by the Chicago Symphony Orchestra, conducted by Rafael Kubelik. HMV OALP 1083.

On the whole, I would class this as another "best" recording, although whether you agree with me would

depend on your own personal taste.

The chief competitor is Furtwangler on another HMV recording, a disc which impressed me not a little, but annoyed me at the same time from an interpretative point of view.

This new release isn't "done over" in anyone's manner — it is straightforward Tchaikowsky, with all the weight and abandon so completely essential to a good performance.

It is possible that a little bit of "top" has been lost on the line. It was probably an AES record to start with, but the fact that I liked it best with NAB seems to point to some change en route from USA to Australia. I preferred this curve not to tame highs, which aren't there in the wide range sense, but to add some body and load the bass a bit.

I think it must lead the Scherchen record by Westminster, which is noisier and brighter, but not as generally successful.

If you are looking for a "Fourth", I'd say this was it. The surface has a fairly consistent rustle, but it doesn't get much chance to be heard.

MOZART—Quartet No. 18 in A Major (K.464) and in C Major (K.465), played by the Roth Quartet. Mercury MG 10110.

These are two of six quartets which Mozart dedicated to Haydn, whose great admirer he was and from whom undoubtedly he learned much. They are often considered his best, and they are certainly among the most mature of all his compositions. We do not need to look very deeply to hear occasional prophecy of Beethoven in both of them, particularly the C Major.

The Roth Quartet, which has been making records almost as long as I can remember, plays them beautifully. Their ensemble is particularly good; the music flows from them smoothly and in perfect taste.

The recording is very good — not particularly brilliant or forward, but equally as smooth as the performance and with a thoroughly satisfy-

ing balance. There is no mention of a playback curve on the jacket, and there often is with Mercury, but found the NAB sounded best and gave a little bass reinforcement. But there is no shrillness to the string and it sounds equally well on brighter on AES. The surface noise is low, and it plays cleanly.

This would be an excellent record for anyone who is looking for a starring point in chamber music, Mozart or otherwise.

MOZART—Quartet in G Major KV387. Played by the Haydn Quartet of Brussels. Radiola Telefunken LB6035.

I found this a very pleasant record in which one of Mozart's finest quartets is presented with great competence.

But it lacks, to my mind, sufficient sensitivity and flexibility to make the most of the music.

The first movement, for instance, is played much too quickly, and opportunities to fully explore the music are brushed aside in the process.

This brisk, four-square approach seems to be symptomatic of many present day quartets. This is a pity, because, by its very nature, a good quartet can achieve a subtlety and an intimacy equalled by no other combination.

The players do better in the andante movement and particularly in the last, their brightness is well placed.

Recording is quite good and surface noise low.

DVORAK.—Concerto for Cello and Orchestra in B Minor Opus 104. Played by Antonio Janigro and the Vienna State Opera Orchestra (in the Vienna Konzerthaus), conducted by Dean Dixon. Westminster WL5223.

This I think is the most beautiful of the cello concertos, and I have never heard it to better advantage than on this record. In fact, I doubt whether I have ever heard a better recording of a cello concerto than this.

It is not a powerful instrument and can easily lose itself against a full orchestra, unless the recording is handled with great care. But nothing like this happens here. Partly because the orchestra is not overlarge, the recording chamber isn't too big, nor the reverberation too long, and because someone has been extremely judicious in microphone placement. The net result is particularly smooth and completely convincing.

Musically, the performance is of high order. The cello has a strong and even tone and the soloist preserves a virtually perfect intonation throughout. I would have liked a little more intensity in places, particularly in the second movement where the temptation to languish hasn't been completely rejected. But the general conception of the music is big, which is as it should be.

Noteworthy are the brass players recorded with fine clarity and full body. In fact, this goes for the complete orchestra, although the horns do tend to empty them out a bit during passages of light orchestration.

I rate this record very highly — about 4.5 stars — and I won't be hurt if you add the other .5 when you hear it. It plays cleanly throughout and surface noise is very low.

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Orchestra conducted by Franz
Litschauer. Nixa VLP430.

An attractive and well-balanced record representing two composers who are intensely national in their outlook, the Norwegian Grieg and the Finn Sibelius.

There is contrast, too, in their work. Grieg never fails to intrigue us with the way in which he can make attractive and interesting things from material which is often absurdly simple—often no more than the movement of a few notes, as in the third of these dances.

Sibelius, on the other hand, digs deeply into deep matters, and if the full weight of his brooding glance isn't met with in this record, his signature is there.

The Vienna players must be the most popular group in the recording world at the moment, judging from the variety of labels which feature them. This is no wonder, for their excellent standard is maintained on this record. Technically, it is exceedingly well balanced, both reverberation and clarity being obtained with good effect.

BEETHOVEN—Symphony No. 7 in A Major, Opus 92. Played by the Berlin Philharmonic Orchestra conducted by Paul van Kempen. Philips A00180L.

Without doubt, this is a very good record of Beethoven — sincere, well balanced and authentic. It is also well found and vigorous — there is no languishing in the second movement, which can sound intolerable in the wrong hands. Here I felt that both orchestra and conductor were playing music they loved and understood. Neither was using the music as an expression of themselves, as I fear many others tend to do.

Moreover, I felt that it improved as it went along. The recording is quite a contrast from the brilliance which is fashionable today and which is the natural result of the movement of recording technique.

It has a real concert performance atmosphere about it, complete with a reverberation which I thought tended to cloud the tone somewhat—the impression is of an orchestra playing through the reverberation, which at times catches up with itself. The result is spatial and massive, but not as clearly defined as otherwise it would be.

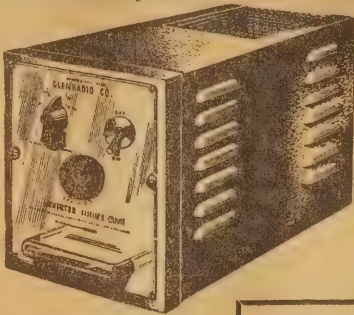
I liked it as much for some of these things as in spite of them. And the surface noise, I rejoice to say, is almost completely absent — a first-rate pressing. Good Beethoven and first-class playing.

★ ★ ★

Nixa have a series of winners in their Clef records, three of which were sent to me this month. To the serious student of jazz they should bring some essential library additions. Norman Granz's Jazz at the Philharmonic, Volume Six, I thought stood out from the others—an actual performance recording of instrumental virtuosity that really gets you in. Close on its heels is a recital from Gene Krupa's Sextet, just as effective in its own way. Artie Shaw and his Gramercy Five I thought was good if you like so much Artie, but to me it wasn't in the class of the other two, nor was the recording as good. If you think there is nothing to jazz, try Norman Granz for size!

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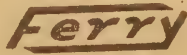
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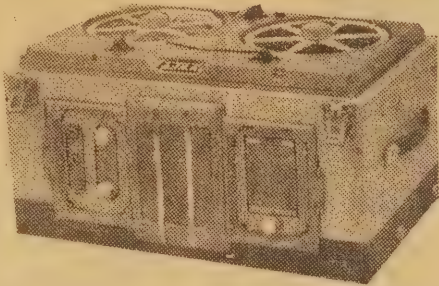
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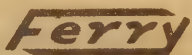
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PRE-RECORDED TAPES PROMISING

The prospects for pre-recorded tapes if anything appear to grow brighter as time goes on. It now seems quite probable that the idea is far from being a flash in the pan. It may not be long before such tapes will be available in Australia.

AND it does appear that the idea is catching on. There have always been some firms making pre-recorded tapes on a limited scale, but we shall undoubtedly see all the recording companies following the lead in supplying tapes for the enthusiast and discs for the average man. Although the idea of an average man in the radiogram business has undergone a severe change of late years.

There are so many more people now interested in good quality and spending their money on it that, if we subtract the large army which doesn't take record-playing as a serious interest, we have a long gradient from the occasional record-buyer to the rabid enthusiast, with a real dividing line.

At any tick of the clock we are able to find some of the less interested types branching out into more elaborate set-ups with blazing enthusiasm, and rarely, once bitten, do they ever go back.

MANY WILL BUY

So that although it is hard to say how many will fall for the pre-recorded tapes, it seems a fairly safe prediction that if the tapes are good and the problem of playing them back can be satisfactorily solved, enough will be sold to make it worth while.

Making tape reels looks a much more flexible business than making discs. The process, as I have previously pointed out, involves no more than running a master tape through a playback deck, and making simultaneous copies which are ready for use as soon as the run is finished.

There is no messy, time-wasting and expensive procession of disc-cutting, plating and pressing. Once a disc is made, it's made, and that's all there is to it. If the records don't sell, even the material can't be recovered and turned into some other record without going through the whole record-making process once again.

USE OF REELS

But if a tape recording isn't popular, the reels can be used again and fed into the copying machine, complete with its erase heads, just like reels of virgin tape.

You don't need a big factory to do all this. Unless it is one which makes the tape you use for your recordings.

It's the reproducing end of the business which looks to me to have the major snags, at least at the present time.

In a sense they are similar to those we now have with discs.

I don't know whether you have ever tried to play back wide-range tape on different playback heads, but

you can take it from me there are plenty of difficulties.

Not the least is playback head design. You can't get wide-range from a 7 1/2 in tape unless you have a good tape head. And if you fail to get wide range, you may as well listen to the radio instead.

Head alignment in particular becomes extremely critical, with high quality, narrow gap heads, and the better they are, the more critical it is.

Without expanding the subject further, I would say that complete mechanical compatibility is the first essential for best tape results. And that's something which at the moment doesn't exist in the home.

RECORDING STANDARDS

Secondly, what about recording standards? Almost every playback machine has a different method of applying compensation. Some do it all during recording and some do it partly during recording and partly on playback. Just imagine the chaos there would be when they all try playing back tape which may use yet another standard!

Until we have some agreement on such matters, so that the grim lessons of playback curves for records are not repeated, there is little hope of real progress with tape for the home.

There isn't any need to be lugubrious about any of these things, for they are quite capable of solution if tackled from the start.

How will we play back the tapes? Is special equipment needed?

Well, as a starting point, a well-recorded modern tape will give from a high impedance playback head about the same output as a modern

magnetic pickup—in similar terms, about 50 millivolts.

As an example, I have played back most of my tapes by feeding them straight into a Playmaster with a No. 2 control unit, and got all the volume I could want.

Now the latest control unit can be operated on an input of 6 milliwatts, so that there is no trouble about feeding the tape head into the ordinary pickup channel.

If the tapes, therefore, could be standardised on a simple curve which could be accommodated by the ordinary control unit, there need be no difference between using the tape or the disc as far as the equipment is concerned.

In my case, I have enough over-all gain to include a small equalising pad between the head and a control unit, if I desired. But I feel that the answer would be to try and make tape equalisation fit in with the general pattern of that used for records.

PLAYING DECK

As for playback facilities, I cannot help feeling that the simple deck which fits over the record turntable would receive a new lease of life if the price were right.

All the user would do is to place the deck in position, set his motor speed probably to 78 rpm, and plug the lead from the playback head into the pickup input jack. Probably he would turn his equaliser knob to a special tape position.

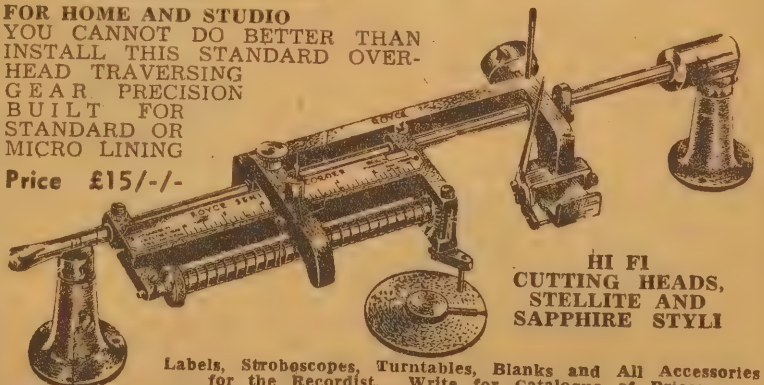
He would then proceed to play his wide-range tapes through his ordinary—or extraordinary—amplifier.

It sounds good to me, and I have satisfied myself that it works. I am sure you will be hearing more about such things before long.

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RECORD NEWS FROM ABROAD

By DISCOBOLUS

Details are now available of what must surely turn out to be the largest project yet undertaken by any of the record companies. I refer to a series of discs just released on the English market by a subsidiary of Deutsche Grammophon, to be called the Archive Production.

THE purpose of the recordings is along the same lines as HMV's story of Music in Sound, but the German set has been conceived on a far broader scale than EMI's. All about 50 LP's will be issued, and the music will range from the Middle Ages through to Mozart, in that the company calls "Research periods," 12 all told.

All the music is presented in its authentic form, as far as possible on instruments which conform to the pattern required to illustrate each "period" faithfully. Although many of the artists featured are unknown here, a number of top artists have been used, and reviews seen far speak very highly of the discs. The recordings are, of course, available separately.

DECCA 45's

As indicated last month, Decca's have arrived. The company is using also the Capitol and Brunswick labels, but to me, at any rate, the issue has been disappointing. (Although quite large in number, the discs are confined to the Pop field, and from what I have seen they include no Extended-Play. There are no news of any forthcoming list of LP's from Decca, nor is there any indication that they will sell 45's items such as overtures or operas and the like. So it looks as though their Medium Play recordings are here to stay, for the classical releases at least.

Meanwhile, HMV and Columbia have for November about 40 new 45's of all types of music. They are, frankly, bound to build up their catalogue rapidly after their recent slaughter of 78's.

Turning to LP's, some companies have already listed their Christmas releases. HMV have Bach's St. John Passion, on three LP's, with the Robert Shaw Chorale in a new English translation, and Carols, sung by the Royal Choral Society under Sir Malcolm Sargent. On Columbia, the choir of St. Paul's Cathedral, London, present a further large number of carols and music for Christmas by Mozart and Vaughan-Williams, played by the Philharmonia String Orchestra.

MANFRED

New to LP in England is Tchaikovsky's Manfred Symphony, in a performance by Paul Kletzki and the Philharmonia, which deletes over 10 bars of music from the composer's score. Tchaikovsky's No. 4 gets a new recording, this time by von Karajan and the Philharmonia (this orchestra produces so many new discs these days I wonder they have time to rehearse at all).

A new Columbia artist is Emilie Gilels, who is soloist for the Beethoven Concerto No. 3. Geza Anda is featured once again, with the Tchaikovsky Concerto. Denis Matthews has another new disc, the

Mozart Concerto No. 23, and Louis Kentner plays the four Chopin Scherzi. Eine Kleine is out once more, on Columbia with the Philharmonia, along with Mozart's Sinfonia Concertante in E Flat, which LP has popularised so much.

Philips are pushing ahead with their LP's also, and their latest for English buyers is the Eroica, with the Berlin Philharmonic and Paul Van Kempen, a recording which has been awarded the Grand Prix du Disque in France. Their other discs include scenes from Otello, from an American Columbia recording, the Vienna Boys Choir in items by Mozart, Strauss and Schubert, Faure's Requiem, four Strauss Waltzes, two Concertos by Handel, and a new recording of Tchaikovsky's "Little Russian" Symphony played by the Royal Philharmonic Orchestra with Sir Thomas Beecham.

Monarch Records, who began their release of LP's a short while ago, are continuing with performances from the other side of the Iron Curtain. Their items are quite substantial—Symphonies 6 and 7 by Glazunov, as well as the Piano Concertos of Liszt, Mendelssohn and Tchaikovsky.

COLUMBIA TAPES

Decca have kept in the background this month, and the only new disc I can find from them of any consequence is Facade, this time narrated by Dame Edith Sitwell and Peter Pears. Decca are evidently keeping their Christmas releases for another month, if they have any at all.

On tape, Columbia are shortly to add excerpts from Tosca and the Merry Widow, together with Holst's ballet the Perfect Fool, and the Coq d'Or suite. As with discs, there seem to be good tapes and bad tapes, but the best of them are reported to be really first-rate. The main criticism is directed at EMI, whose reproducer does not do them justice, and is not even equipped with a simple Treble control. Results under these conditions would be on a par with those achieved by the average table radiogram, and should not be taken as an indication of the quality of the tapes. EMI would also do well to look to their labelling—their tapes so far carry no identification marks at all once they are removed from their box.

IN the US, there are now robot telephone exchanges for long-distance calls. A tape-punching machine goes into action as soon as the call is dialled. It takes down the number of the caller, the number being called, and how long the conversation lasts. If there is an engaged signal or no response, the tape records the fact. Later, the tape is fed through other machines to calculate the monthly bill.



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SHORT-WAVE NOTES BY ART CUSHEN

SPECIAL COSTA RICA CHRISTMAS BROADCAST

Radio Station TIFC, "The Lighthouse of the Caribbean", San Jose, Costa Rica, Central America, will broadcast a special Christmas session for shortwave DXers on Friday, December 24.

KEN BOORD, popular shortwave editor of Radio and Television News will be heard in a new role when he plays an half-hour programme of organ melodies over TIFC. The broadcast will come over on December 24 from 3.0 to 3.30 pm. Australian Eastern Standard Time and will be repeated at the same time on Christmas Day.

Frequencies to be used are 9647kcs and 6037kcs and reception reports are wanted and will be confirmed from anyone anywhere in the world. Mr. Philip B. Smith, the Director of TIFC, says all correct reports will be verified by QSL card and that a Reply Coupon is not necessary.

We hope that as many of our readers as possible will try for this broadcast and thus show their appreciation of Ken Boord who over the years has co-operated so willingly with Radio and Hobbies. Ken's home address is 948 Stewartstown Rd., Morgantown, West Virginia, USA.

VOICE OF UN

THE Voice of the United Nations Command, using the slogan VUNC, and operating from Korea, in verifying listeners' reports, has supplied details of the extensive network of Korean and Japanese stations carrying the broadcasts. VUNC (4780) with a power of 2500 watts is located at Pusan, Korea, and also in the network are JBD(9505) 10kw, Nazaki, Japan, and JBD2(9560) 10kw, Yamata, which together with 14 medium-wave stations in Korea and seven in Japan make up the full complement of VUNC.

The programs are in Korean, Mandarin and Cantonese and are prepared in Tokio. These are transmitted from 9.0 pm to 4.0 am, except JBD which signs off two hours earlier. VUNC also transmits from 4.0 am to 8.0 am. The verification signer is Colonel K. K. Hansen, Chief, Headquarters US Armed Forces Far East, Psychological Warfare Section, Tokio, Japan.

NBC PROGRAMS

THE National Broadcasting Company, which operates numerous short-wave transmitters, and carries programs of the Voice of America, the United Nations, and

the Armed Forces Radio Service, has made alterations to its call-letters. The Eastern transmitters, situated at Boundbrook, New Jersey, now use the call WNBC (in place of WRCA) and the Pacific Coasters at Dixon, California, use KNBH instead of KRCA. These stations are well heard throughout Australasia and reports are always most welcome.

The World Wide Broadcasting System, Inc. "The Voice of Freedom" with its international transmitters located at Hatherly Beach, Scituate, Mass., USA, with the call-sign WRUL, operates on 11780 and 15280kcs, in the European Service and is being well-received. This transmission signs on at 5.55 am and is off at 7.45 am after 15 minutes news, with the exception of Sunday when silent. The Latin American transmission (in English) is on 15350 11780 and 9665kcs from 9.15 am to 10.15 am daily. Spanish language programs then follow.

These notes are compiled by Arthur Cushen, 212 Earn St., Invercargill, NZ. All times are Eastern Australian Standard Time.

PIONEER CANADIAN

MANY old-time DXers will be familiar with the call-letters CBRX which stand for one of the pioneer voices of Canada. Operating since 1938 as CBRX, the Canadian Broadcasting Corporation's Vancouver outlet, now CBUX, has been on the air to serve listeners along the Canadian Pacific Coast that could not be reached by regular broadcast-band stations. CBUX has installed a new Marconi transmitter of 1000 watts input and 500 watts output. The antenna array is oriented 25 degrees west of north, beaming the signal along the coast, and is a rhombic, highly-directional, from four towers 50ft high and 240ft per leg. This transmitter is located on Lulu Island, 12 miles south of Vancouver, and the studios are in downtown Vancouver. The frequency is 6160kcs and the verification signer Mr. F. B. C. Hilton, British Columbia Regional Engineer for the CBC.

FLASHES FROM EVERYWHERE

RUMANIA.—Bucharest is now on 6210kcs (replacing 6142) in parallel w 9570kcs in the North American beams. English from 1.0 to 1.30 pm and 2.30 to 3.0 pm.

EGYPT.—Egyptian State Broadcast is at present using a new frequency 11925kcs at 1.0 am to 2.0 with a program directed to Persia. Reports are required and should be addressed to the Chief Engineer, Monitoring Department, Egyptian State Broadcasting, Cairo.

SWEDEN.—"Sweden Calling DXer" will be discontinued as from the end of the year because of a cut in the country overseas broadcasting budget. A new monthly series will replace this week session and will be devoted to various listening groups. It will be heard on the first Wednesday of each month at 2.15 am and 8.30 am and repeated at 5.15 pm. A few minutes of the new program will be devoted to DXing.

FRENCH EQUATORIAL AFRICA. Radio Brazzaville is noted back on 944kcs in parallel with 11970kcs to 11.40 am close down, then again after 3.0 pm.

GERMANY.—"Deutsche Welle", Cologne has a new schedule valid from November 7, 1954, until February 6, 1955: To Far East from 8.30-11.30 pm over 15.275 11.75 and 9640 kcs; to Near East from 12.30-3.30 am and to Africa from 4.0-7.0 am over 11.795, 9640, and 7290 kcs; to South America from 8.0-11.0 am over 9640, 7290 and 5980 kcs; to North America from 11.30 am-2.30 pm over 7290, 5980 kcs and the new frequency of 9735 kcs. There is to be a DX session on the second Tuesday of the month at 9.0 pm over the program directed to the Far East. "Deutsche Welle" appreciates the co-operation of DXers all over the world and will verify correct reports by an attractive QSL card.

JAPAN.—The following new schedule will operate from Radio Japan as from November 1, 1954 until February 20, 1955: 3.0-4.0 pm, JOB 6080kc JOA-3 9695kc; 5.0-6.0 pm, JOA-3 9695kc, JOB-4 11780kc; 7.0-8.0 pm, JOA-3 9695kc, JOB-4 11780kc; 8.30-10.30 pm, JOA-2 7242.5kc, JOB-3 9675kc; 10.45-11.45 pm, JOA-3 9695kc, JOB-4 11780kc; 12.0 am-2.0 am, JOA-2 7242.5kc, JOB-3 9675kc; 2.15-3.15 am, JOA-2 7242.5kc, JOB-3 9675kc; 3.30-4.30 am, JOA-2 7242.5kc, JOB-3 9675kc; 5.0-6.0 am, JOB 6080kc, JOA-2 7242.5kc; 9.0-10.0 am, OB-3 9675kc, JOA-4 11705kc.

RADIO NEW ZEALAND

THE New Zealand Broadcasting Service has advised that from Friday, November 12, 1954 (NZ date), Radio New Zealand will transmit in accordance with the following frequency schedule:—

1. TO AUSTRALIA:
2000-0640 GMT, ZL19, 11.83 Mc/s in 25 metre band.
0355—close down, ZL18, 9.52 Mc/s in 31 metre band.
2. TO PACIFIC ISLANDS:
1700-1930 GMT, ZL7, 6.08 Mc/s in 4 metre band.
1945-0640 GMT, ZL3, 11.78 Mc/s in 2 metre band.
0655—close down, ZL7, 6.08 Mc/s in 4 metre band.

Close down is at 1045 GMT on weekdays, 1120 GMT on Saturdays, 1000 GMT on Sundays.

Please note particularly that transmissions to Australia and the Pacific Islands now commence at 2040 hours GMT and 1700 hours GMT respectively, instead of at 1800 hours GMT.

These new commencing times will be adhered to in the future.

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THE HAM BANDS WITH BILL MOORE

Contests and Competitions, DX and otherwise are of considerable interest to radio amateurs. They vary from hidden transmitter hunts to world-wide DX contests, attracting support from amateurs active in the various fields.

CH summer during the VHF DX season the WIA sponsors a 50Mc contest conducted in memory of well-known amateur, the late Ross A. who was eventually to become one of the world's best-known amateur QST.

Amateurs look forward to this which ensures intensive activity in the 50Mc band during the sporadic openings.

Ross A. Hull Memorial VHF Contest for 1954-1955 will commence on November 1, 1954, and continue until November 31, 1955. A review of the rules follows.

Contacts are restricted to the 50-54Mc band and only one contact with any one station is permitted each 24 hours. Serial numbers must be exchanged RST three figures for CW and RS plus figures for telephony.

Contests to commence at any number between 1 and 100 and advancing by one each contact.

Scoring:—Ten points are scored for the contact with any particular station, state or overseas, 9 points for the direct contact, and so on.

Complete logs should be forwarded to the Federal Contest Committee, Box 100, GPO, Adelaide, South Australia, later than March 1, 1955.

The outright winner of the contest in the Commonwealth of Australia receives an appropriately inscribed certificate and if a member of the WIA holds the Ross A. Hull Memorial trophy for a period.

Certificates will also be awarded to the highest scorer in each call area in Australia and New Zealand.

This contest is the WIA's premier VHF event and creates DX interest on the 50Mc band.

U CONTEST

The 18th BERU contest will be conducted as usual in January.

The previous contests held in January this year were well supported in both transmitting sections, junior and senior.

AMATEUR NEWS FROM OVERSEAS

Class examinations for Novice and Technician Licences in the US require that they be supervised by the amateur themselves, an excellent outlet for the work of amateur radio clubs. The FCC and ARRL have supported the view that radio clubs are particularly suited to carry out such a far better arrangement than of individuals performing such examination duties.

It is hoped that clubs will set up examination committees. The FCC offers support to any club or association willing to carry out this work.

The following are the qualifications required of examiners: They must be at least 21 years of age to give the theory tests, hold an extra advanced, general class amateur licence, and within the past five years held a commercial radio telegraph licence issued by the FCC.

Operators of manually-operated radio stations in the service of the amateur may also conduct examinations.

The work of clubs in this field should be of great value to the amateur radio movement as well as to the clubs themselves. They will by such activity keep much with local intending amateurs who have an opportunity to bolster their membership.

Considerable opposition has arisen in the past to current amateur radio activity by US Service personnel on the Continent.

and more logs received than in previous years.

It has been decided to discontinue the receiving section as few participants were active. This follows the abolishment of the telephony section as from the previous contest. Activity is now restricted to CW only.

The contest is open to all British subjects within the British Empire and mandated territories who are either members of the RSGB or the WIA in Australia, and NZART in New Zealand.

Entrants must certify in the declaration that they comply with the above requirement.

An entrant not located in one of the prescribed prefix zones shall be considered as being in the prefix zone nearest to his station.

Only the entrant will be permitted to operate his station for the duration of the contest.

The contest affords competitors an opportunity of contacting some of the rarer Empire stations if conditions permit, and entrants are assured of an enjoyable competition.

The following is a summary of the rules:—

The event is divided into two telegraphy sections, namely, 1, senior (maximum licensed power); 2, junior (maximum input 25 watts).

The event (both sections) commences at 0001 GMT, Saturday, January 29, and concludes at 2539 GMT, Sunday, January 30.

LOG SHEETS

Entrants will submit two sheets, one covering general information and declarations and the log, and the second sheet the prefix zone analysis.

All entries must be posted within 14 days of the close of the contest, and should be addressed to The RSGB Contest Committee, New Ruskin House, 28-30 Little Russell St., London, WC1.

Operation is restricted to the following bands, 3.5, 7, 14, 21 and 2Mc.

Transmissions must be of type A1 (pure CW) only, and frequent reports

of T8 or less may result in disqualification.

Contacts may be made with any station using a British Empire call-sign in any British territory or British occupational force member, except with stations in the entrant's own zone. Contacts with mobile or unlicensed stations will not count as points.

Only one contact per band with each station will count for points but duplicate contacts should be logged.

The decision as to whether or not a station is valid will rest with the RSGB's contest committee.

For each zone (outside the entrant's own zone) on a specific band, a contact will count 15 points, the second contact 14 points, and so on until after the 14th contact they will count 1 point. This system may be repeated on each band. For entrants outside the British Isles, Zone 2 is subdivided into three zones under call-sign figures.

1. Call-signs with figures 2 and 4.

2. Call-signs with figure 3.

3. Call-signs with figures 5, 6 and 8.

That is, stations signing G3, GC3, GD3, GI3, GM3 and GW3 are all as listed in section 2 above.

Serial numbers must be exchanged and acknowledged. The number is made up of the RST report plus three figures commencing between 001 and 100 and advancing by one for each successive contact.

A trophy or cup will be awarded to the leading entrant in each section.

Certificates are awarded to the leading three stations in each section, also to the leading entrant in each zone.

EMPIRE PREFIXES

The following are the 25 Empire prefix zones: 1—AP, VU, 4S7. 2—G prefixes divided as mentioned above. 3—DL2, MB9. 4—MD, MF, ZB, ZC4, 5A2C. 5—VE1, VO. 6—VE2. 7—VE3. 8—VE4, 5, 6. 9—VE7, 8. 10—VK2, 4. 11—VK3, 7. 12—VK5, 6. 13—VK9. 14—All VP except VP8. 15—VP8, VK1. 16—VQ1, 3, 4, 5. 17—VQ2, ZD6, ZE. 18—VQ6, 8, 9, VS9, MP4, ST, ZC2 (M13). 19—VR1, 2, 3, 5, 6, ZK, ZM. 20—VS1 to 6. 21—All ZD except ZD6. 22—ZL. 23—ZS1, 2. 24—ZS3, 6, 9. 25—ZS4, 5, 7, 8.

Three elements provide a big advantage, practically a necessity to cope with the current competition.

One afternoon and evening's listening produced VP8AZ, VP8AA, VP8AO, LU0AA, VK1EG, VK1PG, YN1AA, ZM6AL, ZD2BFT, FR7ZA, ZS7C, plus many other Africans and South Americans. At one stage VK1EG was contacting ZS7C, the latter was often audible during the period from 1600 to 1800 HRS EAST.

FR7ZA active at 1900 HRS tone and CW his QTH, Post Box 330, Saint Dennis, Reunion.

In early October there was for a few weeks a revival on 14Mc of former DX conditions.

Some excellent prefixes were present during the afternoons and stations operating appreciated the improvement in DX. Many of the old hands were active as a few new countries were audible. They included VK2ACX, VK3CK, VK2DI, VK2EO, VK3AHH, VK3XO, &c., picking out the rarer ones.

Anyone without a beam found the going difficult.

ZD2BFT on telephony 14120Kcs at 1830 HRS.

The 14Mc band has been also opening in the hours after sunrise generally to the US. However, at times for short periods KV's, CN's and CO's have peaked up to S8 to S9.

7MC conditions have provided good DX, too. Stations active have greater chances with simple antennas and many good contacts were made.

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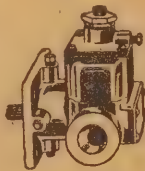
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TH LEADS

as, Mellen, W1FH, again takes up
ber one position in the ARRL's CW
C with 252 countries confirmed.
HW, the previous leader, moves
to second place.
ese adjustments are due to the re-
al from the list of the "UU" station
ity of ST2UU. Incidentally, the
r, Montague Jamie, has been ex-
d from membership of the RSGB.
to his reputed activity using the
call-sign plus required prefix from
ual places when, in fact, he was
in Khartoun.
is a shame such a hoax was ever
etrated as so many stations will lose
its after spending many hours chas-
these elusive prefixes.

NOTES

4KVX, reputedly in Kentucky, seems
be able to produce an S7 to 8 signal
VK at any time. Although a three-
beam is in use, it would appear
the transmitter must be extremely
ative or he is in a location not too
removed from Australia.
e CW section of the CQ contest was
supported by enthusiasts that fol-
this event each year. KV4AA, Dick
nceley, DX editor of the CQ maga-
, made the bare 854 contacts for
roximately 130,000 points!
RM reached high levels on the 7Mc
d with KH6's and W6's, running up
99. Most interesting signal heard here
from CE3AG on 3005Kcs, running up
36 at times.
e Chilean was audible from 1730
il after 2100 HRS; he was contacted
a number of VK and XL stations
oite a very high QRN level.
apanese nationals JA's, as opposed to
s, American servicemen, seem to be
most consistent CW signals heard
14Mcs. Operating practically around
clock, they now are permitted to
phone and most positions of the
band. Previously they were re-
cted to a spot frequency on this
d.

NAVAL DISPLAY

he NSW division of the WIA re-
ed a letter from Rear-Admiral H. A.
owers in late October, expressing
reciation of the assistance rendered
members during the Navy's Trafalgar
y display, held on October 23.
valuable demonstration of the work-
s of amateur radio was given to the
lic during the celebrations, the Navy
rating an amateur transmitter on the
14 and 14Mc bands under the call
22ZAN.
operating from Garden Island, Sydney,
replies were broadcast over the pub-
address system for the benefit of the
olic.
number of amateurs assisted and
Isaacs, VK2ABO's "Mobile Marine"
vity on the 14Mc created much in-
est.
he Naval HQ Sydney Amateur Radio
b has been allotted the call-sign
2ANP and will be active shortly.

IA NEWS

Dr. G. E. Bardwell, VK2IR, of the
roni School of Wireless, discussed
he Importance of Fundamentals to
ateur Operators" at the October
eting of the NSW division.
e stressed the importance of a good
unding in AC theory to operators,
necessity to select correct valves for
ividual positions in transmitters, and
correct Q for tank circuits, besides
ny other salient points.
o solve the problems that arise from
e to time, fundamentals, if fully
derstood, assisted the amateur in
ching the correct conclusion.
he NSW division's annual hamfest,
l be held on January 29. The venue
this year's event, is the offices of
e Royal Agricultural Society at the
dney Showground. Full details will
given over official VK2WI broadcasts.
after serving for many years as
rarian of the NSW division of the
A, Dick Dowe, VK2RP, has resigned,
e to pressure of business. Dick really
tiated the service as we now know it,
d amateurs in NSW appreciated the
vice provided by the library.
The Christmas party of the Hunter
anch of the WIA will be held at the

Charlestown Institute, Newcastle, on De-
cember 4. The party is run essentially
for the wives and kiddies of branch
members.

The NSW WIA's South Western Zone's
Convention was held at Tumut on Octo-
ber 30 and 31 and amateurs attended
from as far north as Newcastle and
south to the Victorian border. 50 mem-
bers and XYL's were present.

The Saturday afternoon was devoted
to a tour of Tumut and surrounding
districts, including a trip to a section
of the Snowy River scheme.

During the evening there was a social
get-together.

Winners of the many competitions in-
cluded Stuart Savage, VK2PL, who picked
the voice; Cess Cronin, the tone; and

Keith Dodd, VK2ZAA, the tune. The
selection of the Box was in the capable
hands of zone officer, Jim Edge, VK2AJO,
who seemed to arrange that the XYL's
should win the valuable pieces of radio
equipment, while OM's received the not-
so-useful parts. The evening's enter-
tainment was appreciated by all in
attendance.

The Sunday events included a one-
hour scramble won by well-known ama-
teur Dave Duff, VK2EO, who, with the
aid of a hastily-erected Vee-beam, con-
tacted no VK's, but listed six different
countries in his 13 contacts.

The 144Mc hidden transmitter search
was won by local zone amateurs, Jim
Edge, VK2AJO, and Lyn Furner, VK2-
AQE, both of Coolamon. Keith Dodd,
VK2ZAA, manned the hidden station.



The most exciting
gifts are always
decorated with
BEAR
B R A N D
Christmas
Tape

MORGANITE TYPES T & R RESISTORS

These low priced BRITISH Resistors combine high performance with unusually small size. They are made accurately to their stated resistance values and are consistently stable.

SPECIFICATIONS

Type	Services Ref.	Rating Watts	Max. Volts	Resistance Range	Body Dimensions
T	RC6L	1	350	10 Ohms/10 Meg.	2" x 3 1/2" dia.
R	RC6K	1	500	do.	2" x 1" dia.

STOCKED IN ALL PREFERRED STANDARD
SIZES FOR $\pm 10\%$ TOLERANCE ONLY

THE MORGAN CRUCIBLE CO. (AUSTRALIA) PTY. LTD.

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PHONE: MU1371. TELEGRAMS: "MORGANITE," SYDNEY PHONE: MX6106. TELEGRAMS: "CRUCIBLE," MELB.

YOUR BRAIN CANNOT THINK!

It is merely the vehicle through which YOU direct every action of your life.

Like an electric motor, it has to be activated by an outside energising force. Your thoughts are but the inner expression of your will directed through your brain to the outer achievement of your desires and your ambition for greater achievement in life. You can learn how to direct your thought energy towards a specific objective to produce positive results. Learn how to marshal your mental powers to improve your business and social career.

The Rosicrucian teachings enable intelligent men and women to benefit almost immediately from the guidance of great intelligences who have progressed far beyond the boundaries of conventional study. If you sincerely feel you are now ready, with an open mind unfettered by orthodox prejudice, to accept new and absorbing truths, write for our free 32-page book, "The Mastery of Life." Dedicated to an inspiring objective, the attainment of the universal Brotherhood of Mankind, the Rosicrucians are a Non-Religious, Non-Political, Non-Profit Making Fraternity.

"The Mastery of Life" has been written to enable progressive, thinking men and women to obtain an insight into the advanced teachings of this Fraternity. You are invited, though not urged, to write for this book. No assurance is implied that every applicant receiving "The Mastery of Life" will be accepted for membership of the Rosicrucians.

Please use the coupon below or write to:

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The ROSICRUCIANS (AMORC)
Box 3988, G.P.O., SYDNEY, AUSTRALIA.

Please send me, without cost, the book, "THE MASTERY OF LIFE".

Name

Address

State

Research Work and the Future

(Continued from Page 13)

argued: the model in the tank will give all the answers. Nearby is another item of wide interest—a pilot model being built for the first stage of investigation by the Severn Barrage Scheme. One more condition which advances with science is cost. The first "atom smasher" built at Cambridge cost a few hundred pounds; the most modern £2-million.

This figure will be easily surpassed by the 10-nation Nuclear Research Laboratory now being built near Geneva, where international science research will be the responsibility of the 10 governments concerned. That is the ideal of science advancement for the benefit of all.

ERMANIUM

Mention should also be made of ermanium research in all its branches. The new transistor will play a vital part in radio, TV, hearing aids and innumerable cases where the normal valve can be replaced, with a saving in space and current consumption.

There is also the Boron-silicon solar battery with its 50 watts output for an area of one square yard; possibly an important contribution to the small-scale production of power in remote areas.

Little need be said of the improvements which science is making in the everyday items of our life.

Three-dimensional pictures, color television broadcast receivers without normal valves, innumerable discoveries in modern science, new synthetics, better aviation, guided missiles, food processing, and a host of inventions, destined to bring safety or greater comfort to our labors.

All of these are in the future as the task of science.

PROBE HOUSING

ed with VTVM's signal
acers etc. . . . Heavy
chrome-plated brass with
oulded Polystyrene and
ittings.

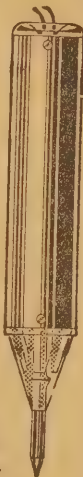
Retail Price 19/6

Distributors

everywhere!

Vatkin Wynne Pty. Limited

73 Pacific Highway, Nth. Sydney



Pocket Book

**STORYTELLER
WEEKLY**
HAS THE PICK
OF THE
WORLD'S BEST
STORIES

HERE'S YOUR ANSWER TOM!

(Continued from Page 55)

to hear it in daytime anyway, because of the distance.

If it is closer than that, you could probably hear it except for those local stations.

When living as close as you apparently do to the transmitting aerials, the signals fed into the set are extremely strong. The set cannot reject them cleanly, which means that they spread over a goodly portion of the band.

If the more distant station is close

to one of the strong locals, then its signal may be blanketed completely. A much more selective receiver would be necessary to receive it.

So there it is, Tom. The short-wave signal could be a spurious radiation but it is more likely to be a proper shortwave broadcast, which you are hearing in the normal way. The direct broadcast signal is probably too weak to be heard above the local stations in a receiver of limited selectivity.

GUARANTEED

Take pleasant tasting, harmless **ALPHA-POWER STOP-SMOKING TABLETS** for a few days until your craving for tobacco is reduced to the degree you wish **OR** if you so desire **ELIMINATE IT COMPLETELY** within 5 days or we will refund money in full, upon return of **WRITTEN GUARANTEE** which accompanies each bottle. Moderate smokers need 50 Tablets for 10/-. Heavy smokers need 100 Tablets for 20/-.

Call or post cheque, postal note or paper money and **ADD 7d.** for return mail postage under plain, sealed cover.

D.K. ALPHA-POWER CO.
Office 40, 3 Castlereagh St.—
2nd flr., 43 Hunter St., Sydney.

CUT SMOKING DOWN OR OUT

—as **YOU** prefer
or your

MONEY BACK

1954 Hi-Fi Book From U.S.A. !!

More than 200 photos and Diagrams! How Hi-Fi works. Some Music Installations. Corner Speakers. Amplification. Magnetic Recording. Records and Fine Music. Instal It Yourself. Modernising Radio Phonos. Do It Yourself Kits. Hi-Fi for Car.

Price 13/6 Incl. Postage.

TECHNICAL BOOK CO.

295-99 Swanston St. MELBOURNE

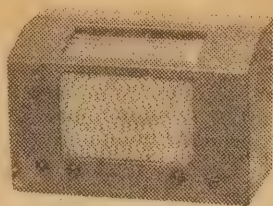
THE "ACOS" MAGNETIC PICKUP



GP32
£2'12'6

Provides a good standard of reproduction with normal equipment at a reasonable price. Element incorporates new high-permeability sintered hi-metal magnet. Output voltage — $\frac{1}{2}$ volt at 1000 cps.

Available from leading radio houses everywhere



£18/15/-
COMPLETE
F.O.R.

SPECIAL PURCHASE

NEW 5-VALVE, DUAL-WAVE, BATTERY MANTLE RECEIVER

Ideal for country Home, caravan, boat, etc.

These five valve dual wave battery receivers made by one of Australia's leading manufacturers give excellent local, interstate and overseas reception. Sets are fitted in attractive and durable plastic covered cabinets using six inch speaker with provision for extension speaker if required.

VALVES USED, TWO 1T4, ONE 1R5, ONE 1S5 AND ONE 3V4.
SUPPLIED COMPLETE WITH VALVES AND BATTERIES.

GRIMES ELECTRIC MOTORS

MADE IN U.S.A.
24 Volts D.C., 1.25 amps.

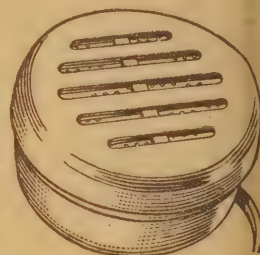
Reversing connections, 11 segments commutator. Size as illustrated, with gearbox 3 x 3½ inches. Supplied complete with reduction action gearbox to approx. 100 R.P.M., also automatic electric brake for quick stopping. May be used without gearbox where required.

PRICE 37/6 each
Packing & postage, 2/- extra.

PILLO-FONE EXTENSION-UNIT

IT'S A REAL MINIATURE
WITH ROLA UNIT

Install it anywhere, in the sick-room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEvised. 3½in Diameter by 1½in deep. POST FREE



22/6

COMMAND RECEIVERS Q.5ERS

New command receivers freq. 190 to 550kc., complete with six valves.

£8/17/6

PLUS
POSTAGE



NEW RELAY-TYPE COUNTERS

These Electronic Counters counting from 0 to 9.999 have a 250 ohm coil

Supplied in brocaded finished box complete with rectifier and transformer for 240v AC operation.

£2/5/-

Plus post.

NEW MAIL ORDER SERVICE

For the convenience of our Country and Interstate customers we have reorganised our mail order department and can now guarantee despatch of goods within 48 hours of receipt of order.

PLEASE PRINT NAME AND ADDRESS CLEARLY ON ALL CORRESPONDENCE.



22/- PLUS
POSTAGE

NEW ACMA "SPORTSHOT" CAMERAS

These streamlined design, precision built cameras in durable plastic, feature precision finished lenses, shoulder strap in matching colour, dual spool adaptor takes 120 or 620 film, finger tip spring return shutter control, direct vision eye level view finder. Takes eight pictures 3½ by 2½ on 620 film.

HIGH FREQUENCY TEST EQUIPMENT

H.F. WAVEMETER TYPE A.B.W.I.

Complete with O-1 ma meter 2 IP5 and 1-958

£6-17-6 F.O.R.

F.H. TEST SET

comprising Signal Generator, 100 to 150 MC and Field Strength Indicator with Meter.

£14-10-0 F.O.R.

NEW AMERICAN WALKIE-TALKIE CHASSIS

Type SCR-536 less valves, case, crystal.

Valves used 2.354, 1.1T4, 1.1S5, 1.1R5 **£7/10/-**

METROPOLITAN RADIO SUPPLIES

479 Parramatta Rd., Leichhardt, N.S.W.
(At top of Taverner's Hill)
PHONE LM3610

NEW I.R.C. RESISTORS

C. Carbon resistors $\frac{1}{2}$, 1 & 2 watt in values 50 ohm to 2meg. including many popular sizes; 15T, 25T, 35T, 50T, 100T, 150T, 500T, etc.

Boxes of 100, 25/-
Standard Resistor and Condenser Colour Code Card Supplied with Resistors.

Synchro nous
motor and drive
in this unit is
ideal for tape
recorders.

NEW COLLARO SINGLE-SPEED RECORD PLAYERS

Type AC54 single-speed record-player with high-fidelity crystal head and automatic stop. For 240 Volts AC operation.

Special Price

£3/5/0

PLUS POSTAGE

Interstate 8/6, N.S.W. 5/-.

**ROTHERMEL SAPPHIRE NEEDLE PLAYS
2,000 RECORDINGS, 5/6**

NEW PHILIPS MICROGROOVE RECORD PLAYER

Philips and Mullard two-speed (78 and 33 rpm) microgroove record players. These units are fitted with a high fidelity turn-over crystal pick-up and automatic stop.

£5/19/6

Postage NSW 8/-
Interstate 12/-
(extra)

Portable leatherette cabinet suitable for above
Cabinet suitable for record changer

£3/15/-

£5/10/-

NEW VALVES

12H7 7/6	6SJ7 12/6	307 22/6
12A6 12/6	6K7G 8/6	866 20/-
12SL7 12/6	6U7G 12/6	813 60/-
12SJ7 12/6	6SA7GT .. 12/6	809 30/-
12K7 12/6	6SO7GT .. 12/6	EBF35 .. 15/-
9001 10/-	6SN7GT .. 10/-	VR99 .. 15/-
9004 10/-	6SH7 7/6	954 10/-
AV11 9/9	7193 5/-	6SH7 in dozen lots
1K7G 9/6	1T4 15/-	each 5/-
1M5G 9/6	VR65A 3/6	1K5 in dozen lots
1C7G 11/6	6AG7 12/6	each 2/6
1L5G 10/6	1K5 3/6	EL33 12/6
		6J7S 12/6

Please add postage.

New Electrolytic Condensers

2 mfd-525V 4/6 each or 48/- dozen plus post
3 mfd-350V 2/6 each or 24/- dozen plus post
5 mfd-600V 2/6 each or 24/- dozen plus post
6 mfd-350V 3/- each or 30/- dozen plus post
0 mfd-40V 2/- each or 21/- dozen plus post

NEW GERMANIUM DIODES TYPE 4A42

Ideal for use as Crystal Detectors, Noise Suppressors, etc. 7/6
POST FREE

CERAMIC VARIABLE TRANSMITTING CONDENSERS

(Suitable for conversion to split-stator).

00pf. double spaced 12/6
60pf. double spaced 10/-
30pf. double spaced 10/-

CERAMIC TRIMMER CONDENSER

Plate silver-plated miniature variable condensers approx. 30pf. screw-driver adjust, with locking screw. 4/6 plus postage.

METROPOLITAN RADIO SUPPLIES

179 Parramatta Rd., Leichhardt, N.S.W.
(At top of Taverner's Hill)

PHONE LM3610

NEW VALVE SOCKETS

Teleton 8-pin octal moulded sockets 5/- per dozen or 25/- per 100.

American 8-pin Loctal high insulation 5/- per dozen or 25/- per 100.

Ceramic Acorn Sockets 5/- each.

CARBON RESISTORS

Well known make of carbon resistors in values of 100 ohms to 5 megohms. In 1-watt, $\frac{1}{2}$ -watt and $\frac{1}{3}$ -watt. All resistors are standard colour coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 $\frac{1}{2}$ -watt, 25 $\frac{1}{3}$ -watt ..

12/6

Post, 1/6.
IN LOTS OF 500, 50/-.
Standard Resistor and Condenser Colour-code card supplied with resistors.

SOLDER

English multi-core solder in 1lb reels.

12/6 per lb.

Postage extra.

NEW MERCURY SWITCHES

The switch with 3 1000 uses.

2/9 Each

CONDENSER SPECIAL

Boxes of 100 new mica and paper condensers in values ranging from 50pf mica to .5 400v paper. Each box includes .0001, .00025, .00075, .001, .008, .02, .05, .1, .5 etc.

Price 30/- per 100

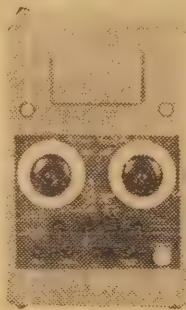
NYLEX HOOK-UP WIRE AT HALF-PRICE

Nylex hook-up wire 10/.010 in 100 yard coils, each coil consisting of five 20 yard lengths in 5 different colours.

10/- PER 100 YDS. Plus postage.

A.R.8—COMMUNICATIONS—RECEIVERS

Converted for 240v. AC operation



Including power supply,
9" x 7" ovaltone speaker

A.P.8 receivers are manufactured by A.W.A. and have a continuous coverage from 140 K.C. to 20 M'CS in six switched bands. Set contains 13 valves as follows: 3-6A8G, 4-6U7G, 2-6V6G, 1-6B8G, 1-X5G, 1-6V4, and 1-6J7. Receiver, speaker and power supply are fitted in attractive and durable plastic-covered instrument case which makes this unit complete and portable. On/off switch and tone control are also fitted.

£34/17/6
F.O.R.

Circuit supplied free with all A.R.8 receivers

UNCONVERTED AR8

Supplied with valves (11) power supply lead and plug. **Air Tested £23/17/6 F.O.R.**

Supplied less valves and covers with power supply lead and plug. **£9/17/6 F.O.R.**

A.C. POWER-SUPPLY FOR AR8

240 volt A.C. power supply for use with any A.R.8 receiver. Supplied in brocaded finished case, with standard A.R.8 power supply plug fitted. Ready to plug into your receiver. Output 250v at 125MA. with 12 and 6v filament windings.



£7/17/6
F.O.R.

A.T.5 TRANSMITTERS

A.T.5 Transmitters supplied complete with valves (3-807 and 2-6V6), plug and circuit

Price **£9/7/6**

A.T.5 Transmitter less valves.

With circuit **£5/5/-**

A.T.5 Transmitter less valves and covers.

With circuit **£4/5/-**

HIGH-POWER I.R.C. RHEOSTATS

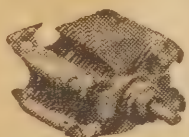
250 ohm, 25 watt.

10 ohm, 21 amp; 25 ohm, 1 amp **10/6**
Price, each

CRYSTAL PICK-UP CARTRIDGES

Rothermel high fidelity pick-up cartridges, replacement for most pick-ups.

10/6 each.



BUTTERFLY CONDENSERS
Capacitance range 3-35 microfarad. Size 11 x 24 x 21 inches. brass plates: Ultra high frequency insulation.

tion: 1 inch shaft.
Price, each **7/6**

Packing and postage: NSW, 1/-; Q., T. and V., 1/6; W.A., N.T., 2/-.

New A.W.A. VIBRATORS

6 volt A.W.A. gas filled vibrators, heavy duty, synchronous. **15/-**
Price
(Special price for quantity.)

D.C. GENERATORS

12V 750 watt. Ideal Home lighting. Battery charging, etc.

PRICE **£3/10/- F.O.R.**

TRICKLE-CHARGER KITS

Kits for trickle-charger as described in R. & H., June issue. Comprising transformer with 18V winding tapped at 12V-3 100mA rectifiers and 50 ohms control.

Postage: NSW, 5/-; Interstate, 7/6. **39/6**

NEW COSSOR C.R.O. TUBES

Ideal for oscilloscopes or TV sets.

VCR97 6in Tube -- -- **47/6**

VCR138 3in Tube -- -- **42/6**

PUSH-BUTTON SWITCHES



5-pole each 2 pair of contacts. Made in USA. Ideal for receivers, multi-meters, etc. Price, Each **10/6**

Packing and postage: NSW 9d. Interstate 1/6.

A.T.5-A.R.8 POWER SUPPLY

24 volt genemotors supply containing two genemotors, one giving 550 volt at 350 mills and the other 250.volt at 100 mills, also contains filter condensers, relays, fuse holders, etc.

£4/10/- F.O.R.

TYPE 1133 TRANSCEIVER

Freq. range 90 to 130 m/cs contains 17 6.3 volt valves.

£8/17/6

METROPOLITAN RADIO SUPPLIES

**479 Parramatta Road,
Leichhardt, N.S.W.
(at top of Taverner's Hill)
PHONE LM3610**

NEW 4 INCH PRECISION SPIRIT-FILLED COMPASS

Complete with corrector **17/6**

Postage 5/- extra

NEW MN26 COMPASS CONTROL-BOX

37/6

23 pin plug for MN26 compass **37/6.**

18 pin plug for MN26 control box, 25/-
Cin Flexible drive for above, 10/-
24in, 18/6.

Postage extra.

SPECIALS

New Dynamic Mike-Inserts ..	8/6
Bakelite Fuse Boxes ..	4/6
5-Position Push Button Switches ..	12/6
Carbon Mike Trans.	4/6
Throat Mikes ..	5/-
Cutler Hammer Switches ..	2/6
Shielded Hook-up Wire, yard ..	3d
3 gang Standard Condenser ..	20/-
2 gang Condenser ..	16/-
Miniature-Wafer-Switches 4 pole	
3 position. New ..	6/6

NEW WESTON & FERRANTI METERS

0-.5 amp. RF thermocouple ..	9/6
0-3 amp. RF thermocouple ..	9/6
0-4 amp. RF thermocouple ..	9/6
0-10mA DC ..	17/6
0-20 volt DC ..	17/6
0-5 amp. DC ..	27/6
0-10 amp. DC ..	27/6
(All above are 2in flush mount.)	
0-10mA DC English Turner	
3in Round Flush Mounting	25/-

Postage Extra.

SMALL 24-VOLT AC/DC MOTORS



29/6

PLUS
POSTAGE

AMERICAN ANTENNA SWITCHING MOTORS

Complete with 8 Pye-Type Co-ax Bases, M. 1750, Ball Bearing.

AMERICAN REDMOND BLOWER MOTORS

Ball-bearing, fully laminated, 6000 R.P.M., 1 amp spindle $1\frac{1}{4} \times \frac{1}{4}$. Complete with blower, new in carton.

45/-

PLUS
POSTAGE



39/6

PLUS POSTAGE

Small 24v ball-bearing motor. Reversible, fully laminated, approx 1/15H.P.

Size $3\frac{3}{4} \times 2\frac{1}{2}$ with $\frac{1}{4}$ " diameter shaft.

W Transformers Suitable For All Above Motors to Operate off 240v A.C. 30/- ea. plus postage.

Heavy Duty Genemotor

able for conversion to A.C. motor (approx. one h H.P.) Fully laminated. Can be used as 6 or volt generator at 20 or 13 amps £2/17/6 f.o.r.



NEW-AMERICAN TELEPHONE WIRE

ber insulation with stainless steel and copper conductors supplied on metal reels each containing half-mile of wire. £1/15/- per pl. Case lots, each containing six reels (three miles of wire)

£10

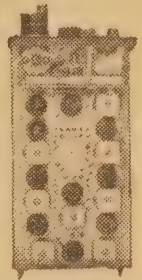
PER
CASE
F.O.R.

AMERICAN H.F. RECEIVER ASB

Complete with 11 tubes, 7 6AC7, 2 6H6, 2 955 Acorns. Can be altered to 144 or 280 Mc amateur band or FM band.

£5/17/6

PLUS POSTAGE.



NEW AMERICAN INDICATOR-UNIT

These indicator units contain the following valves:—

Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2 and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade. In original cartons.

TRANSFORMER TO CONVERT THIS UNIT FOR 240 VOLT OPERATION AVAILABLE AT £3/15/- EXTRA plus postage.

£10/17/6

F.O.R.

240 VOLT POWER TRANSFORMERS AND CHOKES

2000 x 2000v at 600ma.
1500 x 1500v at 700ma.
750 x 750v at 750ma.
240 to 110 at 8 amps.
240 to 110 at 8 amps. auto.
Above transformers
£7/10/- each. F.O.R.

425 x 425 at 150ma. £2/18/-
265 x 265 at 250ma. £2/5/-
365 x 365 at 150ma. £2/5/-
285 x 285 at 150ma. with 5v2amp and
6.3v4amp. fil. windings (standard) £3/5/-
285 x 285 at 60ma. with 6.3v at 3amp
fil. £1/18/-

HIGH VOLTAGE TRANSFORMERS
Primary 240v. Sec. 4:250v tapped at
3:400 and 2:500 £4/10/-
CHOKES
600ma. £2/10/-, 150ma. £1/10/-, 100ma.
15/-, 60ma. 13/-. Freight extra on all
transformers and chokes.

NEW—DYNAMIC—SPEAKERS

New 7in dynamic speaker by leading manufacturer
1500 ohm field coil, 7000 ohm transformer
New ovaltone dynamic speakers 9in x 6in 1000 ohm
field and 5000 or 7000 ohm transformer

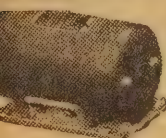
27/6
27/6

SPECIAL PRICE FOR QUANTITY

Postage NSW 3/6,
Interstate 5/6.
POSTAGE
AS ABOVE

MIDGET GENEMOTOR

out 28 to 32 volt at 1.1 amp output 250V



New in carton at 60 MA
£2/15/-

Used but in good order
£1/18/6

out filter supplied
with genemotors

Postage extra

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road,
Leichhardt, N.S.W.
(At top of Taverner's Hill)
PHONE LM3610

OIL FILLED CONDENSERS

2mfd. 1800V --- 17/6
4mfd. 200V --- 4/6
15mfd—600V --- 12/6
20mfd. tapped 600V 15/-
1mfd. 600V --- 5/-
5mfd. 2500V --- 6/6
25mfd. 3000V --- 6/6

Postage extra

SPECIAL DISPOSALS METER



OFFER
0-1 amp meters,
AC-DC 2 1/2 in dial, 45/-

0-1 milliamp,
2 1/2 in dial 37/6
Weston 0-50 volt
0-100 amps com-
bined M/coil, £3/10/-

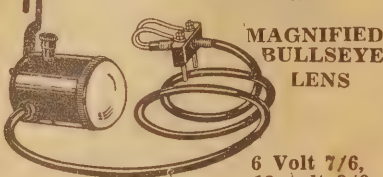
English 50-0-50 Ammeters, M/Coil 37/6
English 0-50 Ammeters, AC-DC 42/-
English 0-40 Voltmeters, M/Coil 25/-
English 0-300 AC-DC Voltmeters 55/-
English 0-5 Milliammeters, 2 1/2 in 27/6
English 0-25 Ammeters, 2 1/2 in M/c 30/-
English 0-10 Ammeters, 2 1/2 in dial, 45/-
Moving Coil
English 0-30 Voltmeters, 2 1/2 in dial, 42/-
AC-DC
English 0-40 Ammeters, 2 1/2 in dial, 42/-
AC-DC
English 0-30 Ammeters, 2 1/2 in dial, 45/-
AC-DC
English 0-150 Voltmeter, 3 in dial, 39/6
Moving Coil
Eng. 0-500 Micro Ammeter, M/Coil 37/6
Eng. 0-20 amps, 2 in dial, M/c. 25/-
Eng. 0-13 Milliamps, 2 in dial, M/c. 19/6
Eng 0-20 Milliamps, 2 1/2 in dial, 17/6
AC-DC
Eng. 20-0-20 Ampmeter, M/Coil 37/6
Eng. 0-30 Amps AC-DC 2 1/2 in dial 42/-
Eng. 0-50 Amps AC-DC 3 1/2 in dial 75/-
Eng. 0-60 Amps AC-DC 3 1/2 in dial 75/-
Eng. 0-80 Amps AC-DC 3 1/2 in dial 75/-
Eng. 0-1 Amps DC 2 1/2 in dial 35/-
Eng. 0-5 Amps AC-DC 2 1/2 in dial 45/-
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English Tweezers 6/6 and 5/6
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6 Volt 7/6,
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Complete with flex and plug.

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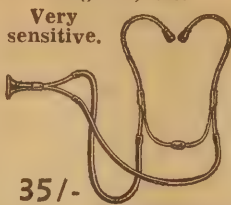


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BRONZE
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Continuous
flow,
£3/19/6.

Ideal for caravans, emptying or filling petrol tanks, watertanks, etc.

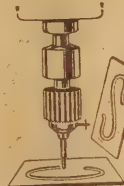
MECHANICS' STETHOSCOPES Ideal for Testing Engines, etc.



35/-

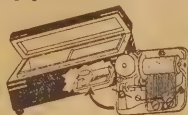
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Cost 18/6
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Now you can make your own music box with these Swiss music units. They can be fitted to any type of box, doll, jug, teddy bears, etc. Hours of enjoyment for all the family.



30/-
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Tunes available: Lili Marlene, Jingle Bells, Blue Danube, Harry Lime Theme, Wedding March, The Merry Widow, Happy Birthday, Annie Laurie, How Dry We Are, Roll Out The Barrel, Silent Night, Teddy Bears' Picnic.

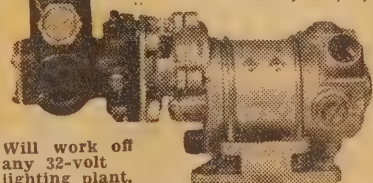
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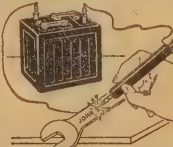


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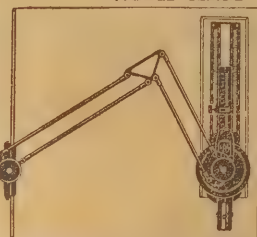
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Ideal for Caravans. Takes the place of Hand Pumps.

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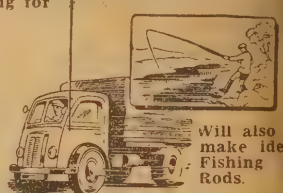
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Do your own panel beating and save £££'s

Improve the appearance of your car. Increase the value of your car. Remove dents the easy way. You can panel beat your car for a fraction of the cost of sending it out for body repairs. Restore bodywork to its original condition.



This high grade panel beating kit will repair damaged mudguards, doors, bodywork, etc. It's so easy to use. Anyone can operate the kit. The instruction book supplied shows you the quick, easy way to panel beat. These tools are made of the best quality forged steel, and are fully guaranteed for two years. The price of this panel beating kit and instructions is only £4/10/-, post free. Send for your kit TODAY and save money. Money back guarantee.

Sensational Car Sponge

Connects to any garden hose. Water flows through the sponge, thus washing dirt away and keeping the sponge clean all the time. Wash your car the quick, easy way. Simply wipe car with sponge. Gives clean and shiny finish. It's so labour saving. No drying or polishing required after washing. This fine quality sponge will never scratch your car. Send today for your car sponge and enjoy the pleasure of this improved method of car washing. Can also be used for washing windows and paintwork on your home. Price £1/5/-, post free.



Magnetic Trouble Lamp

Powerful magnet holds lamp to any part of car body, engine or chassis. Just the lamp for night breakdowns or changing tyres in the dark. Works off car battery. Won't scratch bodywork. Supplied complete with flex and battery clips. Price £1/15/-, post free.

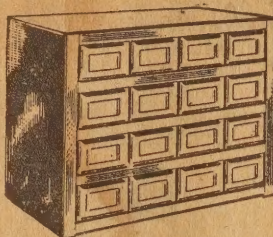
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SPECIAL OFFER: 7/8in diameter thread spark plugs. Price 4 for 12/-, 6 for 16/-, or 8 for £1, post free. Minimum order is 4 plugs. We pay postage to your address. They are brand new plugs made by a world famous manufacturer. We bought a huge quantity at the right price. Therefore, we can sell them at rock bottom price. Please measure the diameter of your plug before ordering. Only 7/8in plugs can be supplied. Owing to the remarkably low price of the plugs we cannot accept orders for less than 4 plugs. Send TODAY for this great bargain.

Pinking Shears

Very useful for sewing. Gives your dress-making that professional look. Best quality imported pinking shears, 7 1/2 inches in length. A most useful present for Mother. A gift that will delight her. Price £2/15/-, post free.

The accessories and tools advertised are quality lines that will give you BIG savings. Efficient after sales service. Read the service you are guaranteed—
Every accessory and tool is guaranteed for two years.
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Small Parts Cabinet

16 drawer all-steel cabinet for storing small parts, tools, nails, screws, bolts, etc. Each drawer is 1 1/2in x 2 1/2in x 5 1/2in in size. Will hold parts or tools up to 5 1/2 inches in length. Identification cards can be fitted on each drawer. Strongly made and most useful. Attractive appearance and finished in baked enamel. Keeps your workshop tidy. Saves time searching for lost parts, etc. Ideal for motorists, mechanics, hobby workers, garages, shops, etc. Price £3/15/- post free.

Brake Re-lining Tools

Set of four tools, comprising chisel for cutting head of old rivet, punch for removing old rivet, punch for driving in new rivet, and a counter-sinking punch. These tools are specially designed for brake re-lining. They do a first class job quickly and easily. Complete set including leather case. Price £1/17/6, post free.



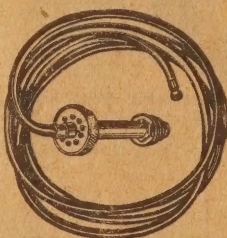
Block Buster

Makes splitting blocks easy. This powerful tool will split tough or curly grained hardwood that an axe would fail to split. It's wedge-shaped blade splits the wood without sticking or jamming. It won't jam in the wood like an axe. Save time and energy with a blockbuster. Makes your work easier on the wood heap. Fitted with a genuine American hickory handle. Weighs 6 1/2lb. Price £2/2/-, forward on rail. Please state your nearest railway station.

Neon Ignition Timer

Amazing new instrument times ignition with perfect accuracy. It is difficult to obtain accurate adjustment when an engine is stationary. The great advantage of a neon timer is that it will time the ignition whilst the engine is running. This means perfect synchronisation and greater efficiency. Precision timing will increase engine pulling power and save petrol. Get peak performance with your car. Complete instructions are supplied with the neon timer. Price £4/10/-, post free.

ENGINE TYRE PUMP



Why pump tyres by hand?

Let your engine do the work

For only £3/18/6 you can get an engine tyre pump that will inflate tyres in approximately two minutes. Easy to use, simply remove a spark plug from engine and screw engine pump into plug hole. Start motor and your tyres are inflated with ease. Can be used on any make of car, truck or tractor. Engine pump and 15 feet of hose. Guaranteed for two years. Only £3/18/6, post free. Please state make and year of your vehicle. Money back guarantee.

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This superior spotlight is supplied complete with flex and battery clips for connecting to your car battery. Price, £4/19/6, post free. Kindly state whether you prefer a 6 volt or 12 volt model.

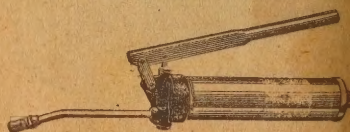


Money back guarantee.

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Locates and diagnoses engine faults by sound. Amplifies sound 50 times. Indicates piston slapping, faulty valves, bearing knocks, broken and worn ball bearings, faulty gaskets, worn water pump faults, frozen shackles, squeaks, worn bearings and brushes in generators, starters, and electric motors, etc. Locate faults in any machine having moving parts. Simple to operate. Price £3/15/6, post free.

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ANSWERS TO CORRESPONDENTS

Vundowie, WA) would like to have a small battery set to take the crystal set and was wondering could help him.

We have a number of one and two battery circuits which will probably suit you, I.O., and a selection of parts, if you wish, may be obtained through our query service at a nominal charge of 2/-. In the meantime, have another look at the "tick one" in the July issue.

(South Perth, WA) sends us a copy of a control unit which has variable feedback characteristics to provide the required compensation. It also offers word of praise for the author who prepares the drawings for Radio and Hobbies, expressing the opinion that they are superior to many diagrams in other magazines.

Many thanks for the circuit C.H. will file it for possible use in the Reader Built It section. It is also interesting to note your remarks about the faults and our draughtsman and to see that the work which goes into this is appreciated.

(Hughenden, Q.) is interested in the Bushfire Radios have been published in Radio and Hobbies and wants to know clearly how a call is initiated in the systems and what is the source of power for the system.

Any mobile system of this type with a number of controls is reduced to a minimum, the receiver and transmitter being fixed tuned and the crystal locked to the frequency by the authorities to the system. The controls normally provided are an on-off switch for the transmitter, a volume control for the receiver, and a press-to-talk button on the transmitter microphone. The system is normally operated with the receiver inoperative and the transmitter in a ready condition with the valve heaters energised. To call another car or station it is only necessary to use the press-to-talk button on the receiver and make the necessary call on the microphone. Operating the press-to-talk button switches the receiver off and applies HT to the trans-

mitter; releasing it reverses the procedure in order that the reply may be received. Interference does cause trouble in all such systems at times but it is usually possible to get the message through by relaying it through another car or the base station. Alternatively a change of operating position will often improve results. The circuits you mention are not intended for the raw beginner and it is assumed that anyone attempting to build one would have had considerable experience in receivers at least and ideally also in transmitters. The power for these systems is normally taken from the car electrical system which is normally capable of supplying what is needed, assuming a reasonable amount of running or some additional charging overnight if this is not sufficient. The automatic nature of the modern car generating system helps a lot in this regard. Sometimes a second battery in parallel with the first will provide longer operating time without charging.

D.S.C. (Wellington, NZ) sends us some descriptive literature regarding an imported pickup which appears to be very popular in New Zealand.

A. Many thanks for the pamphlet D.S.C., which is the first definite information we have had regarding this unit. Though we have heard some previous mention of its excellent performances. Your own comments are also very interesting and we will file this data for future reference in case we have the opportunity to advise readers in this country. At the moment it would appear that currency problems would prevent the large scale importation of these pickups, but the data is extremely interesting.

J.M.C.D. (Bowden, SA) forwards a subscription for Radio and Hobbies and makes some comments about the magazine. He also inquires about the possible use of neon oscillators as a source of signal for an electric organ.

A. Many thanks, J.M.C.D., for your comments and kind remarks about the magazine. We trust it will continue to provide interesting reading. We feel sure that the Serviceman will be glad to receive any interesting case histories you may have. Regarding the neon oscil-

lators we doubt whether they would be stable enough for your purpose, since they are affected by a number of variables, such as temperature, voltage, &c. In the matter of high fidelity equipment we quite agree that a lot of program material is not worthy of such equipment but there are also many programs, particularly live shows, symphony concerts and first class tape recordings, which are of top quality and justify the best reproducing equipment. This combination, once heard, is not easily forgotten, and the urge is there to listen to similar quality material whenever it can be found. It is also true that program quality will not improve, technically, until there is sufficient demand for it, and that demand can only come from listeners who have good equipment. On this score we hope that our own equipment may have contributed something to improve listening conditions.

DJH (Armidale, NSW) is taking a course of radio instruction and writes to enquire whether we are able to help him in the purchase of "beginner's radio sets".

A.: We take it that you are referring to details on the construction of simple receivers, D.J.H. that will assist you in your studies of radio theory. Simple one valve or more, battery circuits or small AC circuits are available through the query service at the nominal cost of 2/-, under the conditions indicated in the panel on this page. However, the purchase of radio components must be made through our advertisers.

No Name (Bairnsdale, Vic.) is puzzled by the fact that the HT in a power supply comes from the apparently earthed side of the circuit in the form of the rectifier cathode.

A. It is true that the HT comes from the cathode of the rectifier but careful examination of the circuit will show that this is not connected to earth. In fact with directly heated rectifiers it is essential to provide a separate filament winding to avoid just this difficulty. Where the filament supply must be earthed it is necessary to use an indirectly heated rectifier where the cathode is insulated from the filament. We may pass this letter on to the Answer Tom section for possible treatment in greater detail at a later date.

R.G.R. (Toorak, Vic.) wants to know if radio waves are affected by passing through media of different colors and if so whether this effect can be measured.

A. No. R.G.K., color does not enter into the behavior of radio waves, the wavelength being so long compared to those of light that the two phenomena must be regarded as quite different. We may pass this letter on to the Answer Tom page for treatment in greater detail.

K.J. (Alphington, Vic.) sends a swag of questions to the Answer Tom page.

A. Many thanks for your suggestions K.J., and we have filed your letters for possible use in this series at a later date. As you can appreciate, it would be impossible to deal with them all in these columns.

E.S. (Belfield, NSW) sends us a diagram of a device for recording Morse signals on a paper strip and suggests that it might be of interest to other readers.

A. Thanks, E.S., and we will consider publishing the details in the Reader Built It section. In the meantime you might consider whether the device could be driven from a phonograph motor rather than by hand.

R.C.M. (Christchurch, NZ) writes to tell us of his appreciation of the magazine in general and in particular to comment on the Serviceman Who Tells series.

A. Many thanks for your complimentary letter, R.C.M. It is most gratifying to hear that the Serviceman articles have been helpful and trust that they will continue to assist you. We wish you every success in your proposed venture.

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of 10 SHILLINGS.

For the same fee, we will give advice by mail, on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special search, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO HILLINGS diagrams and parts lists from our files covering up to three "R & H" instructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 728 C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

Wanted to Buy, Sell or Exchange

Cost of Classified advertisements in this section is 2/- per line, approximately five words to a line. Closing date for January issue of Radio and Hobbies is Wednesday, December 8.

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SELL: 8 mm Movie Projector, takes films
up to 400ft, has a 400 watt lamp, sell-
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Price, 329 Boorowa St., Young, NSW.

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WANTED TO BUY: New or second-
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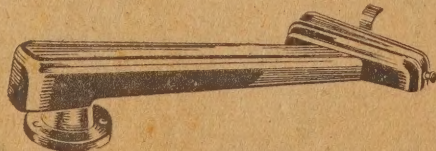
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